# DIFFICULTIES IN IMPLEMENTING DECENTRALISED SANITATION SYSTEMS IN EGYPT EXEMPLIFIED THROUGH THE “GTZ MODEL”

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## Currency Equivalents (effective November 07, 2010)

| | |
|---|---|
| € 1 = LE 8.01679 | LE 1 = € 0.124735 |
| € 1 = $ 1.40301 | $ 1 = € 0.711258 |
| LE 1 = $ 0.175009 | $ 1 = LE 5.71400 |

## Abbreviations

| | |
|---|---|
| CAPMAS | Central Agency for Public Mobilization and Statistics |
| CDA | Community Development Association |
| EEAA | Egyptian Environmental Affairs Agency |
| ESDF | Egyptian-Swiss Development Fund |
| EWRA | Egyptian Water and Wastewater Regulatory Agency |
| GDP | Gross Domestic Product |
| GoE | Government of Egypt |
| GTZ | Gesellschaft für Technische Zusammenarbeit – German Technical Cooperation |
| GWP | Global Water Partnership |
| HCWW | Holding Company for Water and Wastewater |
| HDR | Human Development Report |
| IBRID | International Bank for Reconstruction and Development |
| ISSIP | Integrated Sanitation and Sewerage Infrastructure Project |
| IWRM | Integrated Water Resources Management |
| KWSC | Kafr El Sheikh Water and Sewerage Company |
| LVU | Local Village Unit |
| MALR | Ministry of Agriculture and Land Reclamation |
| MENA | Middle East and North Africa |
| MED EUWI | Mediterranean Component of the EU Water Initiative |
| MHP | Ministry of Health and Population |
| MoEE | Ministry of Electricity and Energy |
| MoED | Ministry of Economic Development |
| MoF | Ministry of Finance |

| | |
|---|---|
| MoHUUD | Ministry of Housing, Utilities and Urban Development |
| MoI | Ministry of Industry |
| MoLD | Ministry of Local Development |
| MoSEA | Ministry of State for Environmental Affairs |
| MoSR | Ministry of Scientific Research |
| MoT | Ministry of Transportation |
| MWRI | Ministry of Water Resources and Irrigation |
| NGO | Non governmental organisation |
| NOPWASD | National Organisation for Potable Water and Sanitary Drainage |
| NRSS | Egypt National Rural Sanitation Strategy |
| O&M | Operation and Maintenance |
| PD | Presidential Decree |
| RSU | Rural Sanitation Unit |
| SFD | Social Fund for Development |
| SSC | Sanitation Service Cluster |
| WWTP | Wastewater treatment plant |

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## Abstract

In Egypt, water supply has considerably improved over the last decades, yet the provision of wastewater services did not correspond to the same extent, and mainly rural areas lack appropriate sanitation systems. As a result of insufficient wastewater treatment and disposal, both population and environment are increasingly threatened by pollution and unhygienic conditions. The establishment of decentralised sanitation systems can support overcome these shortcomings in rural Egypt.

This study aims at investigating difficulties in implementing decentralised sanitation services in Egypt. For this purpose, the establishment of the so-called "GTZ model" – a decentralised sanitation system, in Governorate Kafr El Sheikh in Egypt is investigated. Through the review of scientific literature related to the topic as well as through the review of project documents, and interviews and consultations with different stakeholders, different features related to the topic are investigated. The study mainly focuses on socio-economic and institutional aspects, with special reference to governance. As there is lack of scientific literature that tackles these aspects, this study can be seen as an important contribution towards bridging this gap.

The research concludes that the establishment of decentralised sanitation services is facing difficulties due to various reasons. Such reasons are, for example, related to the embedded approach, which is relatively new for Egypt, and which requires the redistribution of roles and responsibilities between population and government as well as the commitment of both, village communities and the particular governmental administration. Other reasons are, for example, related to certain requirements such as land and funding, amongst others. All difficulties and

constraints, however, can be summarised under two main categories: Governance and financing. The study concludes that the establishments of decentralised sanitation services in Egypt have great potential to solve the above-mentioned problems linked to sanitation, and they contribute to the government's aim of covering rural and remote agglomerations with sanitation services. It furthermore concludes that constraints and limitations encountered can be overcome, if certain preconditions are taken into account. The two main recommendations are therefore, firstly to take time requirements, which are required by changes related to governance, into consideration, and secondly, to review and adjust the current tariff system practiced in Egypt.

# 1 Introduction

Countries in the Middle East and North Africa (MENA) are increasingly challenged by increased wastewater generation. Various factors are causing this situation. First, the MENA region is faced by a growing population, with rising demand for water. On the other hand, during the last decades, infrastructure, such as roads, telecommunication, electricity, and water supply have also improved. Hence, people's lifestyles have changed, which led to, amongst others, an intensive use of water. At the same time, the expansion of sanitation facilities has not kept pace with the rising wastewater generation. Specifically, rural areas lack available proper sanitation systems. Where this is the case, the population uses traditional on-site wastewater systems such as simple cess pits: These simple facilities, however, cannot handle the rising wastewater generation and consequently are overburdened. Moreover, in many cases these on-site facilities lack proper construction and maintenance, which leads to leakage and leaching, and they are therefore a major source of pollution of surface and groundwater, threatening the region's already scarce water resources and the communities' immediate environment (Bakir 2001; Massoud, et al., 2008).

Egypt is no exception to this regard. Water supply has considerably improved in urban and also rural Egypt over the last decades. However, the provision of wastewater services did not correspond to the same extent. Although central waste water systems have been implemented in cities and towns, only a small part of the rural population will be connected to these systems, because most people live in small communities, which cannot be easily connected. In some cases villages do

have a sewer system, but are not connected to any treatment facility (Egypt Human Development Report 2005; Eco Con Serve, 2007). Other villages, especially those threatened by a high groundwater table[1], even built up an informal sewer system which is discharging to drains or canals. For these reasons, in many cases, wastewater generated in rural areas is discharged to the environment with little or no treatment. Due to insufficient wastewater treatment and disposal, villagers are exposed to risk of excreta and water borne diseases. Thus, a rising water table in the Nile Valley and Delta Region is worsening the situation, as this allows an exchange of pollutants between surface and groundwater. Consequently, both population and environment are increasingly threatened by pollution and unhygienic conditions (Egyptian National Rural Sanitation Strategy, 2008).

Generally, the implementation of decentralised sanitation systems is increasingly seen as a fast, promising solution to tackle shortcomings in developing countries, as they are simple in operation and maintenance (O&M), easily adapted to population growth, and usually cost effective and fast to built (Bakir 2001; Massoud, et al., 2008; van Afferden, et al., 2010; Steinbaugh 2010).

In Egypt, the Gesellschaft für Technische Zusammenarbeit / German Development Cooperation (GTZ) developed an approach to provide decentralised sanitation services to small communities in rural Egypt. Since 2002, the so-called

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[1] Due to improved water supply (more wastewater production and hence more leaching from unsealed cesspits into ground) and intensified irrigation, the groundwater table rises. Hence, water penetrates tanks and is filling them up.

"GTZ model", a decentralised sanitation system consisting of waste stabilisation ponds, has been implemented in the Governorate of Kafr El Sheikh, located in the Nile Delta. As such, GTZ is providing technical (and for the first pilot community also financial) assistance, and contracted RODECO Consulting GmbH as a consultant for the implementation.

The approach is community based, and includes that after the establishment of the system, its management is transferred to the village community. Moreover, the village community, meaning the actual beneficiaries, provide the land requirements, and via user charge covers the costs of operation and maintenance (O&M).

Although the first implementations in pilot villages have proven to be quite successful, replication of the model happens quite slowly. The approach is new to Egypt, and the institutional and socio-economic environment are challenging adaption and further replication of the model.

It is the purpose of this study to describe the constraints and challenges faced by the mentioned project, and to investigate reasons that are causing the experienced difficulties. Accordingly, the study is not focusing so much on technical aspects of the established decentralised wastewater treatment plants, but rather, it is mainly investigating the socio-economic and institutional background.

# 2 Literature Review

The challenge of bringing Integrated Water Resources Management (IWRM) into practise can be seen as the starting point of the problem analysis of this study. Reflecting on this subject, Huppert (2005) highlights the difficulties regarding a common understanding or definition of "Integrated Water Resources Management". From his point of view, main misunderstandings are caused by the confusion of the terms "integration" versus "coordination", as well as by the confusion of the understanding of the terms "management" versus "governance". Also Dombrowsky (2004) emphasises the problem of the understanding of "integration" versus "coordination" and the question of their institutional implementation. She points out that the problem of coordination is mainly a problem of cooperation. Van Edig and van Edig's (2004) discussion has a similar direction. In their point of view, decentralisation of sanitation services enables these services to be more efficient, as a centralised public sector is mostly un-coordinated. The mentioned authors show the difficulties in understanding IWRM. They emphasise that it is mainly a problem of where to focus on, i.e. that there is a confusion of different perceptions of how to define "IWRM" or to which definition to refer.

Participation is seen as a crucial factor for the successful establishment and implementation of any (new) approach. Van Edig and van Edig (2004) highlight the importance of participation towards a successful decentralisation. Timmermann, et al., (2008) also highly stress the importance of participation within decision making processes. Ahlers and Ridder (2008) in contrast contend

that participation must not be overestimated, especially when it comes to its power of influence.

In their article, Wagdy and Abu Zeid (2006) give a review of the challenges of implementing IWRM in Arab countries in general, whereby Hvidt (2006) notes in particular the implementation of IWRM in Egypt. He provides an overview of concerned stakeholders, and describes necessary reforms for implementation. In his opinion, IWRM and its implementation in Egypt are still in the initial stages. Viala (2008) also sheds light on IWRM in Egypt, and mainly focuses on problems caused by the current institutional set up.

The term "governance" generally plays a crucial role when it comes to reform processes. Frankel (2005) describes how in developing countries the governmental administrations generally suffer from over-employment, which leads to incompetent and ineffective services, and tend to prevent the expansion and development of certain sectors. A more general overview of "governance" and "political economy" is given by Fritz, et al., (2009) in their report for the World Bank, as well as in the Global Water Partnership (GWP) Background Paper (2003).

Regarding the establishment of decentralised facilities, especially when looking at developing countries, and more precisely the MENA-Region, certain traditional and institutional aspects must be taken into consideration. Research papers of Dombrowsky, et al., (2010) as well as of Lienhoop, et al., (2008), provide quite a broad overview of establishing such systems in Jordan. In Jordan, generally, the central government has the main decision making power, and ministries through

their regional branches within governorates take care of certain public services. For the water and wastewater sector there are three main responsible bodies[2]. These administrative bodies are generally said to have limited communication, to perform without consultation and to even have contradictive interests. In this regard, institutional reforms are discussed. A new Water Law is apparently envisioned, and functions and structures of the water-related bodies shall be redefined. The authors amongst others show the influence of the institutional setup and difficulties regarding (re-)distribution of roles and responsibilities. Moreover, they show stakeholders' perceptions regarding different aspects related to the introduction of decentralised sanitation systems, which can be summarised as follows:

> It was perceived that decentralised WWT&R[3] would solve many of the problems Jordan currently faces, such as pollution of freshwater resources, social and health problems resulting from overflowing cesspits and low income among farmers. However, financing issues, risk of leakage, monitoring, odour and responsibility issues were major concerns. (Lienhoop, et al., 2008, p. 25)

The different studies come up with the result that decentralised solutions are principally feasible in Jordan, "[…] but that this is particularly so, because the Jordanian institutional setting is not as centralized any more as it used to be." (Dombrowsky, et al., 2010, p. 41). They furthermore emphasise that from an institutional point of view, decentralised wastewater treatment plants (WWTP) could have been established to all times in Jordan. However, the reform processes

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[2] Explanations will be given in sections 4.4 and 4.5.

[3] Note of the author: WWT&R= Wastewater treatment and reuse.

of the last years supported the introduction of decentralised WWTPs, as they comprise decentralisation processes that allow the transfer of operation and / or ownership to other (private) facilities.

Bakir (2001), and Massoud, et al., (2008), explain approaches of wastewater treatment and management in developing countries in general; van Afferden, et al., (2010), and Steinbaugh (2010) describe the case for Jordan and Egypt respectively. Hence, the authors distinguish between advantages and disadvantages of both centralised and decentralised sanitation facilities. Nevertheless, there is lack of scientific literature that tackles the socio-economic and institutional aspects, with special reference to governance. This study can be seen as an important contribution towards bridging this gap.

# 3 Methodology

### Study Area

The Governorate of Kafr El Sheikh, Egypt is the study area, which is located in the Middle Delta of the Nile Delta, and represents about 200 villages whose population ranges between 1000 to 10,000 people, and some bigger cities[4].

The study concentrates on villages in which decentralised sanitation services are planned to be or already have been established within the framework of the GTZ supported project "Decentralised Wastewater Management".

### Data collection and analysis

The study was partly conducted as a desk study, and was partly based on field research.

The desk study mainly included a review of literature referring to the theoretical background of IWRM as a concept and the problem of its implementation (referring to the study's objective) in general as well as with special regard to the MENA region and here the focus is on Egypt. In this regard, literature and reports on the state of affairs of Egypt's water sector were reviewed, too, with special focus on sanitation. Furthermore literature on decentralised sanitation systems was reviewed as well as literature concerning problems of introducing decentralised sanitation systems in Arab countries. The desk study also included a

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[4] See Appendix A: Map of Kafr El Sheikh, and figure 6: The Nile Delta.

review of documents and reports about the investigated project. Where necessary, Egyptian law was reviewed.

The field research consisted of semi-structured interviews[5]. This approach allowed flexible changes regarding unplanned questions that came up on the basis of the respective interviewee's responses. Nevertheless, an interview guide has been prepared which has provided the main framework of the interviews and allowed the comparison of the responses of the different interviewees[6].

Interviewees have been:

(a) Experts. Technical experts involved in the GTZ project have been interviewed in order to get their perspective about the project and main weak and strong points perceived by them.

(b) Communities of villages where a decentralised treatment plant according to the GTZ model is already in use, represented by villagers on the one hand and members of Community Development Associations (CDA) on the other hand. These interviews focused on citizens' perspective regarding the introduction of a decentralised sanitation system in their village, as well as on their perceived relation with the governmental counterpart.

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[5] Semi-structured interviews, in contrast to a structured interview, do not have a fixed set of questions but are flexible, allowing new questions to be brought up during the interview. Nevertheless, a semi-structured interview follows a certain framework. See "References "Interview Techniques"".

[6] Some of the questions have been adapted from a questionnaire given by Dombrowsky, et al., 2010.

Villages in which interviews took place were 1) El Moufty El Kobra (Sidi Salem district), and 2) Koleaah (El Hamoul district) (see Appendix A: Map of Kafr El Sheikh).

(c) Representatives of different institutions of the Egyptian government involved in the project: Holding Company for Water and Wastewater (HCWW), Egyptian Water and Wastewater Regulatory Agency (EWRA), and the Kafr El Sheikh Water and Sewerage Company (KWSC) [7]. Here, the main focus was led on their perception of the introduction of decentralised wastewater services in Egypt.

The interviews with representatives of different groups allowed an analysis of the particular group's point of view regarding certain topics. The outcomes of the particular groups were compared and the results further analysed.

Moreover, the research included consultation with different technical experts so as to get a deeper understanding of the complexity of the project.

The interviews were conducted in October and November 2010. They took place in the office of the particular interviewee or in the particular village in case of interviews with the village community. Interview partners of Egyptian institutions were suggested by GTZ or RODECO; and contact was also established through this avenue. Language of the interview was English. In case the particular

[7] A description of the different institutions and their roles and responsibilities is given in later chapters.

interviewee did not speak English, an interpreter translated the interview from English to Arabic and vice versa.

Table 1 gives an overview of all interviews, whereas Table 2 gives detailed information about the particular interview partner:

**Table 1: Overview of conducted semi-structured interviews**

| Group | Institution / Representative | Number of interviews | Language of interview | Date |
|---|---|---|---|---|
| Expert (RODECO) | External consultancy | 2 | English | 19. October 2010 |
| Expert (AL DAR, Egypt) | Internal consultancy | 1 | English | 11. October 2010 |
| GoE | EWRA | 2 | English | 10. October 2010 |
| GoE | HCWW | 2 | English | 13. October 2010 & 14. October 2010 |
| GoE | KWSC | 3 | English / Arabic | 19. October 2010 |
| Community / Village 1 (Moufty) | CDA | 2 | Arabic | 20. October 2010 |
| Community / Village 1 (Moufty) | Villagers | 2 | Arabic | 20. October 2010 |
| Community / Village 2 (Koleaah) | CDA | 1 | Arabic | 23. November 2010 |
| Community / Village 2 (Koleaah) | Villagers | 2 | Arabic | 23. November 2010 |

**Table 2: Interview partner**

| Interviewee | Institution / Representative | Job position | Date |
|---|---|---|---|
| **Experts** | | | |
| Dr. Friedrich Fahrländer | RODECO Consulting GmbH | Team Leader | 19. October 2010 |
| Magda Riad | RODECO Consulting GmbH | Deputy Team Leader | 19. October 2010 |
| Dr. Mahmoud A. Azeem | ALDAR Consulting Engineers | Design of the project, Director of ALDAR | 11. October 2010 |
| **Governmental Institutions** | | | |
| Dr. Mohamed Hasan Mostafa | EWRA | Head of Technical Regulations | 10. October 2010 |
| Eng. Mohamed Atef M. Abdel | EWRA | General Manager, Tariff and Pricing Department | 10. October 2010 (only asked about |

| | | | |
|---|---|---|---|
| Wahab | | | information regarding tariffing) |
| Eng. Mounir Hosny | HCWW | Consultant ISSIP | 13. October 2010 |
| Eng. Mamdouh Razlan | HWCC | Deputy Chairman HCWW; Administration and Financial division | 14. October 2010 |
| Eng. Mouftah | KWSC | Head of Technical support center for sanitation | 19. October 2010 |
| Eng. Nermin Farouk | KWSC | Civil Engineer, Technical support center for sanitation | 19. October 2010 |
| Eng. Mohamed Hisham | KWSC | Civil Engineer, Technical support center for sanitation | 19. October 2010 |
| **Village Community 1 (Moufty)** | | | |
| Ahmed Abdel Ati Abulkheir | CDA | Chairman CDA | 20. October 2010 |
| Maged Abulkheir | CDA | Administration, supervision | 20. October 2010 |
| Anwar Basyani Abu Zeid Alkhadray | Villager | | 20. October 2010 |
| Naglaa Abdel Mawgoud | Villager (female) | | 20. October 2010 |
| **Village Community 2 (Koleaah)** | | | |
| Zakaria Mohamed Attia | CDA | Deputy Chairman | 23. November 2010 |
| Dowaa Mohamed Gouda | Villager (female) | | 23. November 2010 |
| Gehan Ahmed Mohamed Shams Eldin | Villager (female) | | 23. November 2010 |
| **Interpreter**<br>Hisham Marzouk, Magda Riad | | | |

# 4 Situation Analysis

This chapter aims at giving an overview of the general situation that is important within the framework of this study. General conditions and overall environment will be described. In subsequent chapters a more detailed and tailored description of the study area will be given.

## 4.1 Decentralised Wastewater Treatment

In most countries, centralised wastewater treatment plants are the typical facilities found in urban agglomerations. Households are connected to a sewage system, which, via underground carrier networks, transfers sewage away from the populated agglomeration to a single treatment facility that is usually far away from the point of wastewater generation. As such, small household pipes are connected to larger pipes and trunk mains, which are finally linked to the treatment plants. Such collection systems are expensive regarding their construction (digging and installation) and account for 70 – 90% of the capital costs (Bakir 2001; Steinbaugh 2010).

However, where population density is low, decentralised systems are an alternative to the extensive centralised ones. This counts especially for rural areas, where population is scattered over a wide area (Massoud, et al., 2008).

Decentralised wastewater management in this regard is understood as the collection, treatment and re-use or disposal of wastewater at or near its point of generation (Bakir 2001; Massoud, et al. 2008; Dombrowsky, et al., 2010).

These systems are smaller than the centralised ones and are usually localised, whereas in centralised systems, gravity sewers are in use; decentralised systems consist of small-diameter pressurised pipes, small-diameter gravity or vacuum sewers. In most cases decentralised systems are owned by the developer or non-public entities (Steinbaugh 2010).

Figure 1 shows a schematic of decentralised systems, while Figure 2 shows a schematic of a centralised option for the same community.

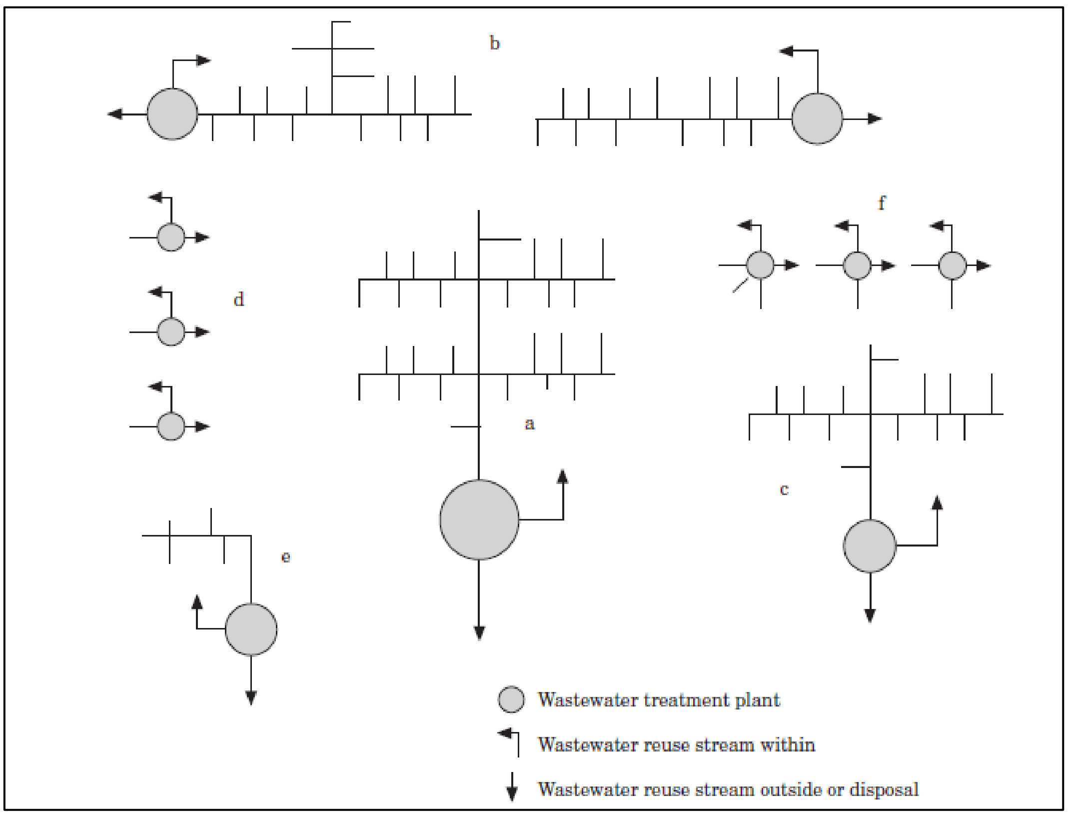



**Fig. 1: Schematic diagram of decentralised wastewater management concept for a small community.**
(a) Subsystem for residential and commercial center. (b) Subsystems for residential neighborhoods. (c) Subsystems for industrial development. (d) Subsystem for individual residences. (e) Subsystem for new development. (f) Subsystems for establishments or clusters of homes.
(Source: Bakir 2001, p. 323)

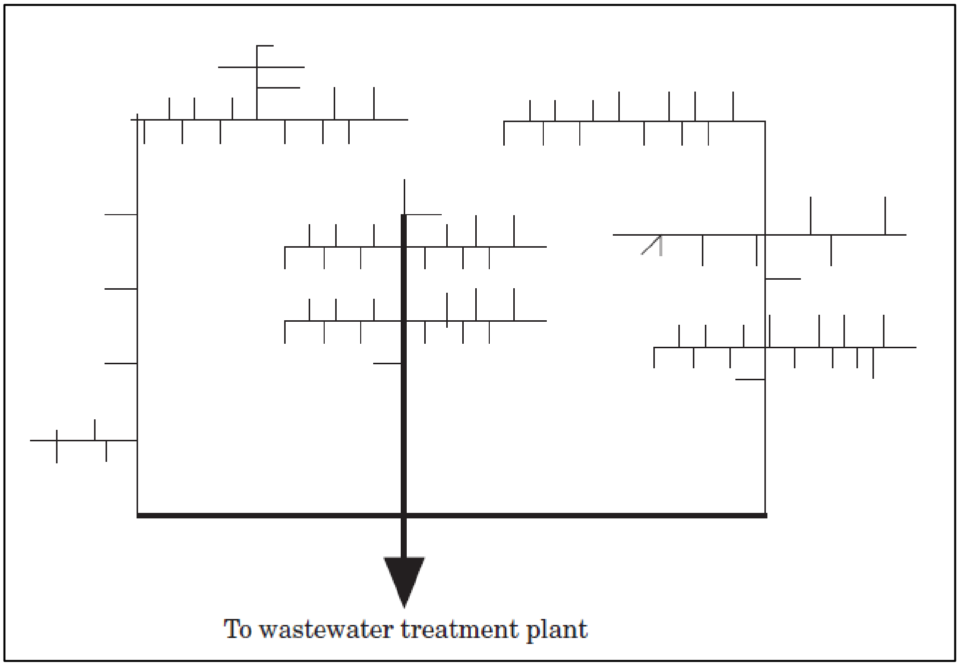



**Fig. 2: Schematic diagram of centralised wastewater system serving the same small community as in Figure 1**
(Source: Bakir 2001, p. 323)

As it can be seen, in figure 1 several treatment plants are in use, while in figure 2 only one WWTP serves the community. Over the last years, the establishment and implementation of decentralised sanitation services (not only) in rural areas of developing countries is increasingly seen as one of the most promising ways to overcome shortcomings in wastewater collection and treatment. Especially for the water stressed region of Middle East and North Africa, where water supply is intermittent and water consumption is low, leading to concentrated loads, decentralised wastewater management is regarded as an appropriate solution. "Expanding wastewater services to small communities in MENA has become essential in order to protect the scarce water resources from pollution and to meet the increasing demand for convenience." (Bakir 2001, p. 320). It is therefore important to mention that decentralised systems are commonly regarded as very

flexible in light of demographic changes, meaning rising population and therefore rising capacity needs (Bakir 2001; Massoud, et al., 2008; van Afferden, et al., 2010; Steinbaugh 2010). This is of great importance, especially when looking at the high population growth rate in developing countries. Generally, capacity of decentralised treatment systems are aligned almost according to the real need and can adapt easily to population growth, while centralised systems on the contrary are not as flexible and are built with overcapacity so to satisfy possible future needs of a bigger population.

Figure 3 illustrates the differences of capacity and flexibility in changes between centralised and decentralised systems.

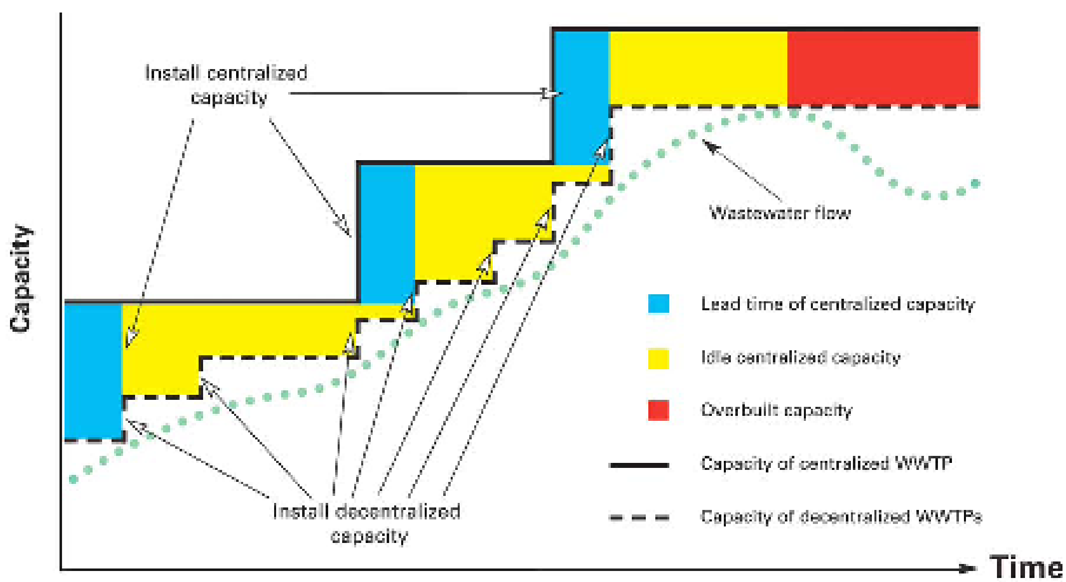



**Fig. 3: Illustrative capacity of wastewater options**
(Source: Pinkham, et al., 2004, cited in Steinbaugh 2010, p. 14)

For a long time rural populations of developing countries have been using on-site treatment facilities, especially where governmental activities of expanding

wastewater services have not reached small communities and which hence are lacking a sewage system. As such, unsealed cesspits are mostly in use. Commonly in such cases there are no effluent disposal facilities; and because of being unsealed, these types of on-site treatment systems allow percolation into the soil and thus contaminate groundwater, threatening the environment and people's health. Proper installed decentralised sanitation systems, however, reduce these effects, and moreover, depending on the technology in use, allow the reuse of treated wastewater.

Massoud, et al. (2008), state, that currently there are more than 70 on-site technologies that exist, and there is not one specific technology but several options for a certain site. Several criteria must be taken into consideration and certain principles must be followed when choosing and implementing an appropriate technology.

## 4.2 General overview of Egypt

The "Arab Republic of Egypt" is located in the very northeastern part of North Africa. The country belongs to the Region of "Middle East and North Africa" (MENA Region), which is said to generally have similar geographical and cultural conditions.

Egypt's climate is dominated by dry, hot summer and moderate winter temperatures. Rainfall is mostly restricted to winter times, during which most rain falls over the northern part of the country bordering the Mediterranean Sea. To the

south of Cairo, Egypt's capital, there is almost no precipitation; about 95% of the country is covered by desert (Mensching and Wirth 1989).

The area covered by the country is 1,009,000.8 km², of which only 3.5% of the land is cultivated – out of which 100% is irrigated land. In 2008, the population was estimated to be more than 75 million; the annual population growth rate is around 2% (Hvidt 2004; Egypt Human Development Report 2010).

The Nile River is said to be the country's "lifeline", as it is the country's sole source of water. Alternatives are limited: the amount of rainfall is negligible, as is fossil groundwater, and desalination as well as water reuse are still in their initial stages. A contract with Sudan signed in 1959 determines Egypt's share of the Nile water to 55.5 BCM, whereas the country's total (natural) water resources are estimated at about 65 BCM. Table 3 summarises Egypt's water resources by source.

**Table 3: Egypt's water resources by source (Years 05/06 – 08/09)**

| Source | Year 2005/06 | | Year 2006/07 | | Year 2007/08 | | Year 2008/09 | |
|---|---|---|---|---|---|---|---|---|
| | BCM | % | BCM | % | BCM | % | BCM | % |
| River Nile | 55.5 | 79.8 | 55.5 | 79.3 | 55.5 | 76.7 | 55.5 | 75.6 |
| Underground water in Valley and Delta | 6.1 | 8.8 | 6.1 | 8.7 | 6.2 | 8.6 | 6.2 | 8.4 |
| Agricultural sewerage recycling | 5.4 | 7.8 | 5.7 | 8.1 | 8.0 | 11.1 | 8.0 | 10.9 |
| Sewage water recycling | 1.2 | 1.6 | 1.3 | 1.9 | 1.3 | 1.8 | 1.8 | 2.5 |
| Rains & Floods | 1.3 | 1.9 | 1.3 | 1.9 | 1.3 | 1.8 | 1.8 | 2.5 |
| Sea water desalination | 0.06 | 0.1 | 0.06 | 0.1 | 0.06 | 0.1 | 0.1 | 0.1 |
| **Total** | **69.56** | **100** | **69.96** | **100** | **72.4** | **100** | **73.4** | **100** |

Source: adapted from CAPMAS, 2010

As it can be seen, the amount of water available from the River Nile is constantly the same, and complies to the 1959 contract with Sudan. Furthermore it can be seen that water recycling and water reuse does not yet play an important role in Egypt. Although Egyptian law recognises water reuse and there are set standards and codes, developments are still in their initial stages. The Egypt National Rural Sanitation Strategy envisages a greater role of water reuse, but it is to expect that in the near future no great changes will happen.

Agriculture consumes about 80%, which is the biggest share of the scarce water resources. The agricultural sector's share of employment is about 40%, yet it contributes only about 13% to Egypt's Gross Domestic Product (GDP) (Wagdy and Abu Zeid 2006; Abdel-Shafy and Aly 2007; Viala 2008; Egypt Human

Development Report 2010). Bearing this in mind, almost all of the agricultural land is concentrated in the delta – as well as the majority of the population – with the rest of agricultural land being distributed along the Nile between Cairo and Aswan (South of Egypt), and along a small line along the Mediterranean coast. Second biggest source of water withdrawal is the industrial sector (11%), followed by the domestic sector (7%) (Badran 2010).

## 4.3 IWRM in Egypt – towards reforms in the water sector

This section aims at providing an overview about the importance and status quo of IWRM in Egypt. Before, however, the concept of IWRM as well as possible difficulties to its implementation shall be described. Understanding the difficulties and constraints of bringing IWRM into action is important for a further approach of the study, as in most cases they mirror difficulties and constraints faced by the subject of investigation.

### 4.3.1 IWRM – Difficulties of its common understanding and implementation

Without doubt, following the conferences in Dublin and Rio de Janeiro in 1992, the concept of IWRM – "Integrated Water Resources Management" – received international recognition and countries all over the world exerted effort to manage their water resources under the umbrella of the IWRM approach.

Yet, bringing IWRM into practice is a challenge mainly due to the fact that IWRM does not simply provide a guide or handbook one can follow step by step.

To the contrary: IWRM, its implementation and approach can be quite diverse. This can already be seen when trying to define what IWRM actually is or includes – there is not one short, universal definition but many definitions, each highlighting other issues. The most common definition though is the one given by the Global Water Partnership (2000):

> Integrated Water Resources Management is a process which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

As mentioned, however, there are plenty of definitions (Hermsen 2009; Viala 2008; Huppert 2005; Dombrowsky 2004).

Confronted with all those definitions, Huppert (2005) developed a helpful classification which makes it possible to assign a definition in respect of its focus to one out of three groups:

1. Definitions which are emphasising an *intersectoral* dimension of water resources management.
2. Definitions which are emphasising an *intrasectoral* character.
3. Definitions which are emphasising the need for a joint and comprehensive management of the diverse resources as water, ecosystems, land, etc., as they are all interlinked.

This grouping shows that the main impasse toward understanding and implementing of IWRM is the confusion between the terms “integration” and “coordination”, which can hinder successful implementation when it is unclear on

which dimension the respective party is focusing (Dombrowsky 2004; Huppert 2005).[8] In Egypt, as well as in other MENA countries where tasks related to water are distributed over many institutions and administrative units, water can hardly be managed in an "integrated" manner by one entity, but management must be "coordinated".

In this context, Huppert (2005) emphasises that generally it is not possible to have one type of superior "management", since many different administrative institutions and levels are concerned. Instead, in order to be able to manage water (or better: activities related to water) in a coordinated manner[9], it is important to develop mechanisms that aim at achieving one determined goal – these mechanisms are to be reached via governance.

According to GWP (2003), governance and IWRM are closely related: "IWRM demands a new framework within which there may be a need for significant changes in existing interactions between politics, laws, regulations, institutions, civil society, and the consumer-voter. The capacity to make these changes depends therefore on changes in governance." (GWP 2003, p. 4).

In this respect, one can say that the term "coordination" in this context can be understood as governance; as such, a holistic framework requires a wider concept as a function of management (Huppert and Urban 1999).

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[8] Understanding that "integration" refers to integrate the management of different sectors under one entity, and "coordination" refers to coordinate the management of actions, e.g. through joint consultations of the different entities.

[9] In the following text the term "coordination" is used, as from the point of view of the author this term reflects the actual context and meaning rather then the term "integration", especially in the case of Egypt.

The term “governance” therefore plays a crucial role when looking at sanitation services in Egypt.

### 4.3.2 The difficulty of implementing IWRM in developing countries

Following the Dublin principles and the GWP, bringing IWRM into practice requires an enabling environment, an institutional framework allowing and supporting this environment, and furthermore requires management instruments needed by these institutions in order to fulfill their respective tasks. As described, the requested “coordination” furthermore in most cases implies the need for institutional change and reforms, leading to well functioning governance.

This necessity leads to the following complications: Regarding higher administrative levels, resistance is likely to arise because most institutional changes require the activation of the principle of subsidiarity[10]. Viala (2008, p.3) believes that “One of the essential components of the evolution towards IWRM is to ensure the existence of a proper institutional framework where decision-making is delegated as much as possible (“subsidiarity principle”).” The focus is on the local level, and an attempt is made to achieve democratic management processes in the water sector by empowering water users and local managers (bottom-up approach), including that they do not only receive responsibility but also the authority to fulfill certain tasks.. Mainly in developing countries the embedded

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[10] “Principle of subsidiarity”: To decentralise responsibilities (and moreover authority, note of the author) and management to the lowest appropriate administrative level (European Community Commission 1998). According to the European Community Commission, this principle is an internationally agreed principle governing water-related activities.

call for institutional and managerial change is likely to be perceived as a threat (Hvidt 2004; Viala 2008). In this regard Frankel (2005, p.20) states that “There is great resistance to commercialization of services traditionally performed or provided by government, not only because of fear of loss of employment but more importantly loss of political influence and power.” In his opinion, “One of the most persistent problems in developing countries is the size, competence, and effectiveness of their civil service and therefore government administration.” (Frankel 2005, p.19). In developing countries it is very common that people are given a job by their government, even though they might be unskilled and not qualified for the work in question. The same holds true for Egypt: it has a welfare system, and amongst others is providing employment opportunities (Egyptian Human Development Report, 2005). As a result, people feel that it is their right to be employed by the government. Thus, this attitude is found not only amongst lower ranks of employees, but also amongst their superiors, including senior managers, and in some cases, also government leaders. Leaders have to fill government jobs with supporters can be identified as one explanatory factor. This situation may consequently lead to incompetent and ineffective civil services, as institutions are overstaffed and employees in many cases do not or hardly meet required qualifications.

Yet, it is not only the issue of unskilled labour, but also the fact that public sector salaries are low and fixed (extra effort is not awarded), so that employees – even if skilled – in most cases do not have the incentive to exert much effort (Hvidt 2004).

In conclusion, the establishment of IWRM – and development measures in general – is likely to face the obstacle of lack of political will to admit and to enforce (necessary) changes. In this regard it is clear that:

> Obstacles to development are largely manmade. They can be reduced and often eliminated, if there is a will and a way to make radical institutional changes, develop, train, organize, and use human resources more effectively and reduce the huge waste of corruption, administrative incompetence, and mismanagement. (Frankel 2005, p. 268)

It is necessary to acknowledge that not only institutional and technical changes must be addressed when approaching IWRM, but also a broad change in the socio-cultural environment, i.e. in mentality, behaviour and attitude, which requires much time and effort (Timmermann, et al., 2008; Viala 2008).

Furthermore, it acknowledges that there is interdependency between the mechanisms of governance (referring to laws, rules and regulations), the institutional framework and the socio-cultural environment which is based on traditions and cultural norms.

Figure 4 shows the interdependency and gives a rough idea about how much time certain changes are likely to need, and which are likely to slow down development processes.

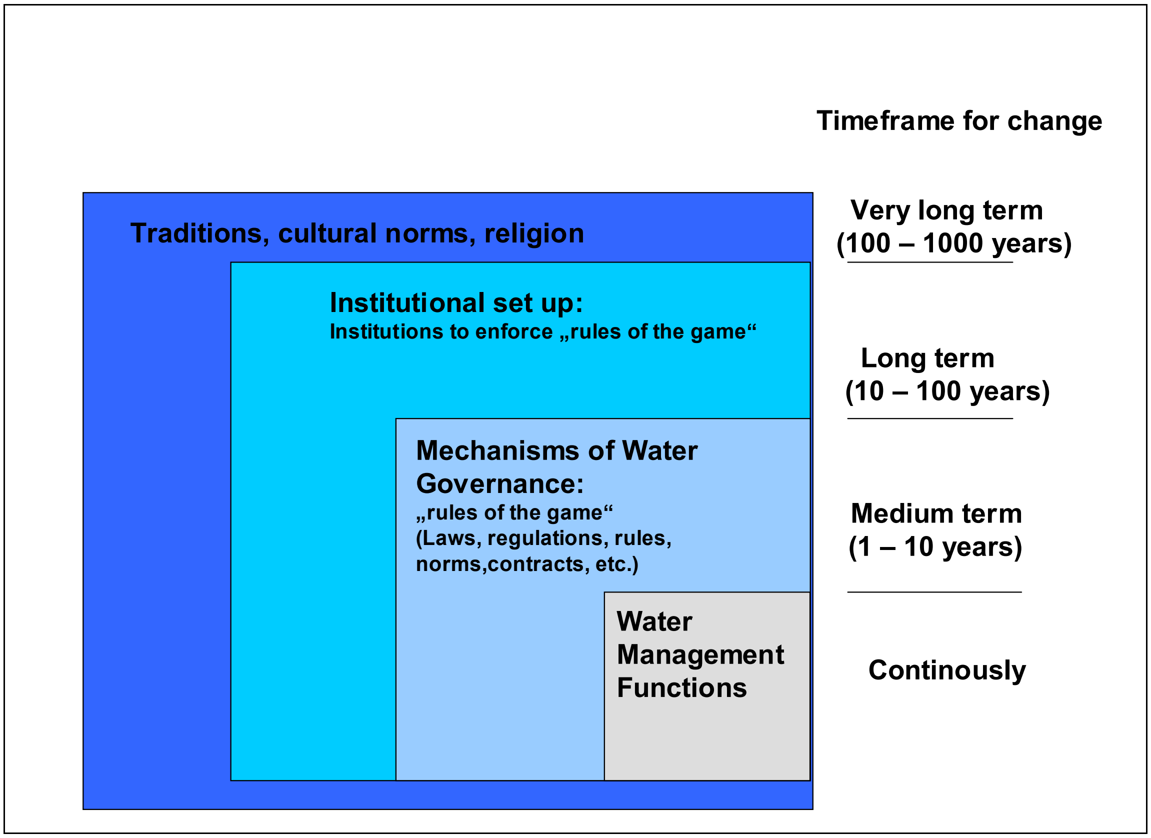



**Fig. 4: Interdependency of fields referred to water governance and their timeframe of change**
(Source: Adapted from Huppert 2009, on the basis of Williamson 1999)[11]

### 4.3.3 The status quo of IWRM in Egypt

Countries of the Arab World generally are faced with water scarcity. High population growth results in a growing demand and competition for water. Also, climate change is expected to further add pressure on scarce water resources[12].

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[11] Original figure was kindly provided by Walter Huppert. Used reference: Williamson, O.E. (1999). *The New Institutional Economics: Taking Stock/Looking Ahead.* ISNIE Newsletter, Vol. No. 2.

[12] As such, it is important to mention that due to climate change water flow of the Nile is expected to increase. However, it is questionable which riparian countries will make use of this additional flow (Steinbaugh 2010).

Challenged by this situation, Arab countries increasingly see the need for reviewing their national water strategies and developing new approaches within the framework of IWRM. However, although the need for change is obvious and accepted by particular governments, associated necessary reform processes remain quite slow (Hvidt 2004; Wagdy and Abu Zeid 2006; Timmermann, et al., 2008; Viala 2008).

Egypt is no exception in this way. The Egyptian population is growing very fast, and it is estimated that population will reach more than 90 million by 2025. Also upstream claims put further pressure and threaten Egypt with a reduced share of water coming from the Nile River. Currently, available water resources are already fully utilised, meaning that in order to be capable to satisfy the growing future demand, new resources must be developed, and / or utilisation must be modified, aiming at using water more efficient. The latter requests a broad reform. Wagdy and Abu Zeid (2006) state that the Government of Egypt (GoE) shows high political will towards reforms under the umbrella of IWRM. Necessary steps are apparently defined and major constraints that need to be addressed are identified. Such constraints are mainly management potential and coordination of the related sectors of agriculture, water supply and sanitation as well as other sectors. The Egyptian Ministry of Water Resources and Irrigation (MWRI) is primarily responsible for reform processes linked to the water sector. In consultation with other ministries, the MWRI developed national water policies that aim at an integrated approach as given by the concept of IWRM. Hvidt (2004) mentions that it is not only pressure emanating from unsatisfied demand,

but also pressure from the donor side, mainly from the World Bank (WB) as the largest lending agency in Egypt, which request the establishment of reforms that involve the IWRM approach. In this way, according to Hvidt, uncoordinated or conflicting spending shall be avoided, leading to an increasing efficiency.

More than ten ministries are involved in the Egyptian water sector and its management[13]. Until recently each ministry had set up its own policies, including the ones related to water, which resulted in uncoordinated planning (not only) in the water sector. For example, sanitation, wastewater pollution control and water resources management have been disconnected from each other regarding terms of profession, organisation, and finance. Taking this into account, the already developed "National Water Resources Plan" is one first step towards coordinated planning with respect to IWRM[14]. Nevertheless, coordination and communication amongst the involved ministries is still insufficient and unsatisfying to the holistic approach required by IWRM (Hvidt 2004; Badran 2010).

To address these shortcomings, the Egyptian government over the past years exerted much effort toward implementing IWRM. The MWRI, in addition to other ministries, has expressed its strong commitment to IWRM, to Institutional Reform, to the principle of subsidiarity, and to increase the involvement of water consumers and the private sector. National policies have been developed to support these commitments and necessary steps in order to implement the

[13] A detailed stakeholder analysis defining the role of all parties involved will be made at a later point (see paragraph 4.5.3).

[14] The National Water Resources Plan of Egypt will not be described in detail in this paper. For more information see Hvidt (2004), and the Website of MWRI (http://www.mwri.gov.eg).

mentioned commitments have been undertaken, e.g. the development of the above mentioned National Water Resources Plan or the stimulation of an institutional reform process and others (Hvidt 2004; Viala 2008; Badran 2010). Generally speaking, an enabling environment shall be created. However, necessary reform processes and institutional changes in respect of IWRM are still in their initial stages. According to Hvidt (2004), the main challenge is observable in the implementation of those reform activities, or better: reform intentions.

Viala (2008) describes some of the reasons causing these challenges, taking the set-up of MWRI as an example: To cope with the limited water resources and hence to be able to manage the associated increasing complexity of tasks, the MWRI established various authorities, units and departments for different fields related to the water sector. This resulted in a relatively independent operation without sectoral integration, hence in fragmentation, which "[…] drastically hampers cross-sectoral coordination, timely decision-making, and thus modern (integrated) water resources management." (Viala 2008, p. 1). There is no holistic knowledge about the situation in other command areas, so activities may contradict, counter-impact, or be double.

The same is true for consultations between the MWRI and the Ministry of Housing, Utilities and Urban Development (MoHUUD), which is the other major institutional body in the water sector. Historically, the institutional coordination structures between both ministries were limited to data exchange, whereby also planning across both sectors was limited.

In conclusion, it can be said that in Egypt, reform processes and institutional changes towards implementing the IWRM approach are ongoing. Yet, efforts are in their initial stage due to various reasons, and the coordination of the different stakeholders and therefore the coordinated creation of an enabling environment can be seen as one of the main challenges.

## 4.4 Institutional set-up of Egypt's water sector

In this section, ministries involved in Egypt's water sector shall be listed and the role of key stakeholders shall be briefly described[15]. At a later point, stakeholders mainly involved in sanitation are going to be described in detail.

Ministries involved in the Egyptian water sector are as follows:

- Ministry of Water Resources and Irrigation (MWRI)
- Ministry of Agriculture and Land Reclamation (MALR)
- Ministry of Housing, Utilities and Urban Development (MoHUUD)
- Ministry of State for Environmental Affairs (MoSEA) / Egyptian Environmental Affairs Agency (EEAA)
- Ministry of Health and Population (MHP)
- Ministry of Industry (MoI/GOFI)
- Ministry of Scientific Research (MoSR)
- Ministry of Electricity and Energy (MoEE)

[15] For detailed description of the respective ministry's works, see MED EUWI 2, 2009.

- Ministry of Local Development (MoLD)
- Ministry of Transportation (MoT)
- Ministry of Tourism
- Ministry of Interior

Referring to Hvidt (2004), the key stakeholders beyond the ministries are the MWRI, MALR, MoHUUD, MoSEA, MHP and MoI. Beyond these, the MWRI plays a key role regarding irrigation and drainage, as it has "[…] the sole legal responsibility for water resources planning and management in Egypt." (Hvidt 2004, p. 6).

MoHUUD is the most important stakeholder within the framework of this study, since it is responsible for water supply infrastructure and wastewater collection and treatment as well as their planning, construction and management in rural and urban areas.

Furthermore, all these institutions have their sub departments as well as their local and regional entities[16]. Until now, planning and the establishment of water related policies mostly happen independently and individually within each ministry – signifying that policies are therefore not national policies, which results in a lack of coordination and communication (governance), as described previously.

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[16] They will not be further mentioned here. At a later point, however, important entities within the sanitation sector will be described.

## 4.5 Sanitation in Egypt

### 4.5.1 General overview

In Egypt, coverage levels of sanitation are on average quite low, with tremendous differences between urban and rural areas. Egypt's biggest cities, Cairo and Alexandria, have an adequate number of treatment facilities, which in most cases have advanced treatment stages (secondary as well as tertiary treatment). In some areas of Upper Egypt[17] and the Nile Delta Region, however, some treatment facilities for domestic wastewater serve only primary treatment (Abdel-Shafy and Aly 2007).

As numbers referring to sanitation coverage levels for Egypt vary with their respective source, a definition for "sanitation" according to the Egypt Human Development Report (2005, p. 178) shall be given: "Sanitation is defined as the process of separation of human excreta and other waste products from contact with man and the environment through hygienic collection methods and safe management practices."

Bearing this definition in mind, the Egyptian National Rural Sanitation Strategy (NRSS) (2008) states that in 2002 about 85% of rural residential buildings had some type of sanitary facility, in which 10% out of the 85% were connected to sewage systems, and the other 75% relied on individual means (septic tanks,

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[17] Egypt's division into Upper Egypt and Lower Egypt dates back to ancient Egypt. Northern Egypt is described by the term Lower Egypt and comprises the Nile Delta; Upper Egypt on the other hand is in the South and comprises the (fertile) land on both sides of the Nile Valley.

house vaults)[18]. Sanitation levels increased over the last years, and according to the NRSS (based on data of the Central Agency for Public Mobilization and Statistics, CAPMAS) in 2006, about 24% of buildings in the villages were connected to sewer systems. The connection of buildings in the Delta was thus 33.7% (Upper Egypt: 11.65%). The coverage level of sanitation for urban areas of Egypt in the same year was 82% in total (MED EUWI 2, 2009)[19]. The numbers are also reflected in table 4.

**Table 4: Access to improved water source and connection to sewer network for the year 2006 (in %)**

| | Greater Cairo | Egypt, urban | Egypt, rural | Egypt, total |
|---|---|---|---|---|
| Water supply, total | 99.5 | 98.8 | 92.9 | 96.6 |
| Sanitation, total (connection to sewer network) | 94.7 | 82.5 | 24.3 | 50.5 |

Source: Adapted from MED EUWI 2, 2009

The table moreover displays, that the overall connection rate to sewer systems for whole Egypt is 50.5%. It is imperative to highlight that coverage levels, especially

[18] Note: Rural Egypt here includes villages of both Upper Egypt and Nile Delta Region.

[19] It must be considered that data vary according to their source. Badran (2010) in his study mentions that 68% of the urban population is connected to sewerage system, and 18% have improved sanitation levels, i.e. septic tanks and similar means, and in rural Egypt only about 13% of the population is connected to sewerage services, and 68% have an improved sanitation situation. Furthermore, Abdel-Shafy and Aly (2007) state that in rural Egypt 95% of the population is neither connected to sewer systems nor has access to wastewater treatment facilities, and that the other 5% mostly rely on private means of excreta and wastewater disposal, e.g. septic tanks and latrines. When comparing different sources, the data of Abdel-Shafy and Aly (2007) are most negative and doubtful. It must be highlighted, furthermore, that connection to a sewerage system does not necessarily imply connection to a WWTP – this can contribute to the confusion of data.

for rural Egypt, are significantly low. As a matter of fact, the coverage levels of sewage systems in cities are greater than the ones in villages. Moreover, in many villages the population built informal sewers, which are not connected to any treatment facility. Consequently, most rural wastewater is discharged into the environment without any or very little treatment, threatening both human health and nature. Wastewater of formally established sewer systems is discharged into agricultural drains and, in some cases of informal sewers, wastewater is discharged into irrigation canals as well. Also, rising water tables in the Delta, caused by perennial irrigation and increased provision of drinking water, are expected to increasingly lead to the malfunctioning of on-site treatment facilities systems, which consequently leads to an exchange between surface water and groundwater, and hence leading to the contamination of groundwater (Abdel-Shafy and Aly 2007; Eco Con Serve, 2007; Egyptian National Sanitation Strategy 2008).

The Egyptian government is increasingly aware of the problem and its effects, and over the past years has developed several measurements to tackle rural sanitation problems. One major goal is to ameliorate the sanitation situation in rural Egypt through the safe collection and also treatment of wastewater. This requires on the one hand, the enlargement of sewage systems, and on the other hand, the establishment of new WWTPs.

All related measurements must be seen at a national scale as the institutional set up of the sanitation sector for (rural) Egypt involves many stakeholders and therefore relies on their cooperation and coordination.

### 4.5.2 Water and wastewater tariffs (households) in Egypt

Egypt is a welfare nation. Many basic products (bread, sugar, oil, etc.) are highly subsidised, and prices of goods do not reflect their real value. The same can be said for public goods and public services, including water and wastewater services (Egypt Human Development Report, 2005; Badran, 2010).

As for households, the price of water is LE 0.23 per $m^3$ of consumption of water up to 20 $m^3$ per month and LE 0.65 per $m^3$ above a consumption of 20 $m^3$ per month. Wastewater charges consist of a surcharge of 35% of the water charge (MED EUWI 2, 2009).

Tariffs for water and wastewater are generally the same in all governorates, as tariffs are uniformly set by the Cabinet High Committee on Policy and Economic Affairs. Moreover, the set tariffs have remained fixed since 1995, and only wastewater surcharge for the business sector increased once in 2003 to 70%. There is no utility in Egypt fully covering the costs of O&M for wastewater treatment via user charges (Badran, 2010).

These subsidies are increasingly burdening the GoE, and due to this dynamic the government developed a new economical policy, which changes its role of being the main provider of jobs, goods and subsidies. Subsidies shall be reduced, wages increased and costs covered through gradually increasing tariffs, through which needs of the poor are still in focus (Badran, 2010).

### 4.5.3 Institutional set up of the Sanitation Sector[20] (Rural Egypt)

Over the past years many institutional changes transpired in Egypt's water sector. The Egyptian government recognises that it is currently confronted with an institutional set up that is no longer able to satisfy needs and demands, and that the financial gap is increasing. In this regard, a National Water Resources Plan (NWRP) was developed, which can be seen as a first step towards reforms and new (national) policies in the water supply and sanitation sector (Badran 2010; Hvidt 2004).

In the past, the water and wastewater service was the responsibility of local administrations, as urban systems have been under the authority of city councils, and rural systems under governorate housing departments. Capital planning and supervision of design and construction was under the responsibility of central agencies belonging to MoHUUD. Several reforms were achieved over the years[21], and in 2004, the water sector faced a significant structural reform: A national Holding Company for Water and Wastewater (HCWW) was established, and all public water and wastewater authorities were converted into public companies and transferred to the ownership and management of the HCWW. Capital works

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[20] According to the Egyptian Human Development Report (2005, pp. 179) one cannot talk about a "sanitation" sector in Egypt: "While the Holding Company is under the authority of the MHUNC [which is the MoHUUD, note from the author] the latter is not the sole provider of sanitation services on a national scale since it is only concerned with public sewerage systems; its activities do not cover the provision of standalone technologies for individual households in the rural areas. Furthermore, it does not make of sanitation a 'sector' that is under the tutelage of the Ministry of Housing." However, in the following text it will be referred to the "sanitation sector", especially considering ongoing reform activities in the water sector.

[21] For further information on these reforms see MED EUWI 2 (2009); Badran (2010).

responsibilities, however, remained to a great extent under the auspices of public work agencies of MoHUUD; with the Cairo and Alexandria Potable Water Organisation (CAPWO) responsible for Greater Cairo and Alexandria, and with the National Organisation for Potable Water and Sanitary Drainage (NOPWASD) for rural Egypt. Moreover, capital works are funded through state budget and/or international grants and loans (MED EUWI 2, 2009).

Next, the institutional set-up and (governmental) key stakeholders of the *sanitation sector* will be described in detail. As such, only the key stakeholders important for *rural Egypt* will be mentioned.

Primary authority is the *Ministry of Housing, Utilities and Urban Development* (MoHUUD). As the MoHUUD supervises the sanitation sector in Egypt, it can be said as having major decision-making power.

The *Egyptian Water and Wastewater Regulatory Agency* (EWRA), established by Presidential Decree (PD) 136/2004, started operations in 2007 with the purpose to:

> […] regulate, follow up, and monitor all activities related to water and wastewater at the national level - whether these activities are carried out by governmental projects, projects that were granted concessions to work in this field according to law, or water and wastewater units established by private sector projects. (MED EUWI 2, 2009, p. 23)

In this regard, EWRA is responsible for monitoring and regulating sector performance, and furthermore sets a benchmark by which to improve the efficiency and quality of service delivery.

The above mentioned *Holding Company for Water and Wastewater* (HCWW) was established under PD 135/2004 in order to convert former semi-corporatised public authorities into subsidiary public companies, whose purpose is to commercialise water supply and sanitation utilities so as to achieve greater managerial autonomy. Finally, under PD 249/2006, all water and wastewater facility assets of all governorates have been transferred to the HCWW. PD 135/2004 (Article 2) describes the purpose of the HCWW as follows: "treatment, desalination, transportation, distribution, and selling potable water; collection, treatment, and safe disposal of wastewater." (MED EUWI 2, 2009, p. 25).

The HCWW is the key planning and oversight institution, it has the mandate of managing and operating water and wastewater utilities, and hence is responsible for supervising water supply and wastewater treatment facilities. HCWW key activities are to thus undertake actions that improve the performance and efficiency of utility companies, e.g. billing and financial planning, but also decentralising utility organisation structures. It must be highlighted that HCWW does not receive state budget funding, but should seek commercial financing or borrowing from the National Investment Bank (MED EUWI 2, 2009).

The *National Organisation for Potable Water and Sanitary Drainage* (NOPWASD) was established under PD 197/1981 and is defined as a "[…] technical implementing agency under the jurisdiction of the MoHUUD, responsible for sector planning and co-ordination at the national level." (MED EUWI 2, 2009, p. 26). NOPWASD is therefore responsible for planning, design, construction and supervision of water and wastewater facilities as well as their

networks in *rural* Egypt. On national level, it is responsible for most water supply and sanitation projects, and has to report back to MoHUUD. Its works are funded by the state budget.

*Kafr El Sheikh Water and Sewerage Company* (KWSC) is one of the companies that are subsidiary to the HCWW. KWSC is important for the study, as it is linked to the water and sewerage sector in the Kafr El Sheikh governorate. In general, the role of subsidiary companies is to review and follow up projects, and to coordinate them in all of the planning, implementation and operation phases (Wehrle, et al., 2007). As a result, the KWSC, like all of the other affiliated companies, is completely self sufficient in O&M measures, and is consequently responsible for its financial performance.

A general overview of the institutional set up is given in Figure 5:

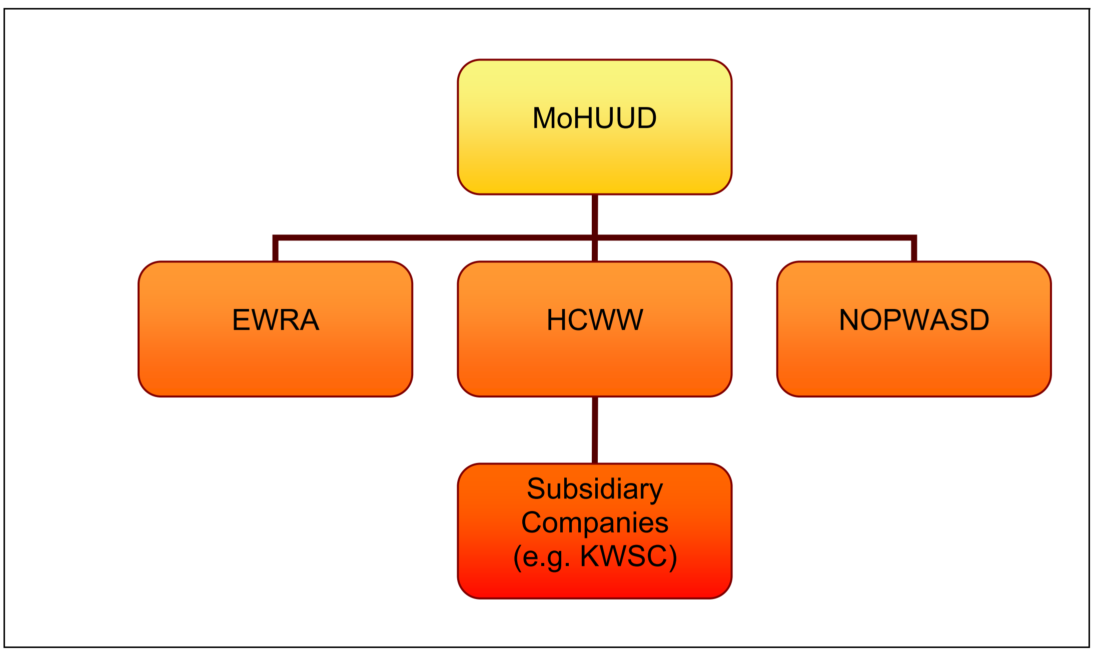



**Fig. 5: Institutional set up of the most important governmental stakeholders for the sanitation sector (rural Egypt) (status: 2010)**
(Source: Adapted from MED EUWI 2, 2009)

Other important institutions in Egypt's sanitation sector include the *Ministry of Economic Development* (MoED), which approves amongst others investment projects, the *Ministry of Finance* (MoF), which plans, prepares and manages the State Budget. It is imperative to mention that "Although holding companies and their subsidiaries, including the HCWW and its subsidiaries, are not supposed to receive state budget funding, PD 249/2006 authorises the MoF to be responsible for paying any O&M cost deficits "until the companies achieve financial balance"" (MED EUWI 2, 2009, p. 28). Furthermore, the *Ministry of Water Resources and Irrigation* (MWRI), which sets the standards for municipal effluent discharge, the *Ministry of Health and Population* (MoHP) (amongst others sets standards for drinking water quality, and is, together with the MWRI, responsible for monitoring, sampling and testing of drinking water and effluent quality. In this regard, it can order the closure of any facilities that fail to meet the standards), the *Ministry of State for Environmental Affairs* (MSEA) (amongst others responsible for environmental monitoring and enforcement of environmental law; its executive is the Egyptian Environmental Affairs Agency, EEAA), and others.
Furthermore, there is a broad number of other stakeholders, comprising both governmental and non-governmental[22].

It becomes manifest that the institutional set up of Egypt's water sector is quite complex. Sanitation alone involves a great number of governmental stakeholders,

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[22] The ones mentioned are the most important entities regarding the framework of this study.

with simultaneously different and overlapping roles and responsibilities. This dynamic challenges governance mechanisms of the water sector, but also – looking at the framework of this study – regarding the project which will be investigated in the upcoming chapters.

#### 4.5.4 Egypt National Rural Sanitation Strategy – Sanitation Service Cluster

Increasingly aware of the rural sanitation problem, the GoE through the MoHUUD commits to the implementation of the National Programme for Rural Sanitation. According to this programme, the HCWW developed the National Rural Sanitation Strategy (NRSS); the final document was approved in September 2008. The strategy aims at achieving the goal "to ensure public health and [safe/healthy] environment, and protect water resources through the provision of safe and effective wastewater and solid waste collection, conveyance, treatment, and disposal services to all Egyptian rural communities" until 2040, the target year (Egypt National Rural Sanitation Strategy, 2008).

The major element of the strategy is the development of Sanitation Service Clusters (SSC), meaning the division of rural Egypt into clusters, taking geographical and institutional conditions into account (adapted from Egypt National Rural Sanitation Strategy, 2008):

- Geographical Prospective: SSC is an area of geographical bound that include a group of villages in which the planner is sure that their inclusion in one project is the optimum solution from technical, economic, environmental, and institutional points of view.

- Institutional Prospective: SSC is an administrative unit of the rural wastewater sector, and which is a part of the organisational structure of HCWW companies.

As for the approach, a cluster is centered around one treatment facility. The cluster, as such, consists of a maximum number of villages. Following this approach, economies of scale can be achieved.

Some smaller villages are not feasible to connect to the centralised (cluster) treatment plant. These are, for example, villages which are located too far from the facility, or which need supplementary infrastructure like crossings under roads and waterways. Such villages have another solution at their disposal, e.g. a decentralised system.

# 5 Decentralised Sanitation Systems in Kafr El Sheikh, Egypt – The GTZ Project

In chapter 4, a broad overview of the situation into which the project of investigation of this study is embedded is provided. In this chapter, a closer look into the study area will be given, followed by a situation analysis concerning the project.

## 5.1 General overview Governorate Kafr El Sheikh

The governorate of Kafr El Sheikh is situated in the northern part of Egypt, in the Middle Delta of the Nile Delta Region, about 120km to the East of Alexandria.

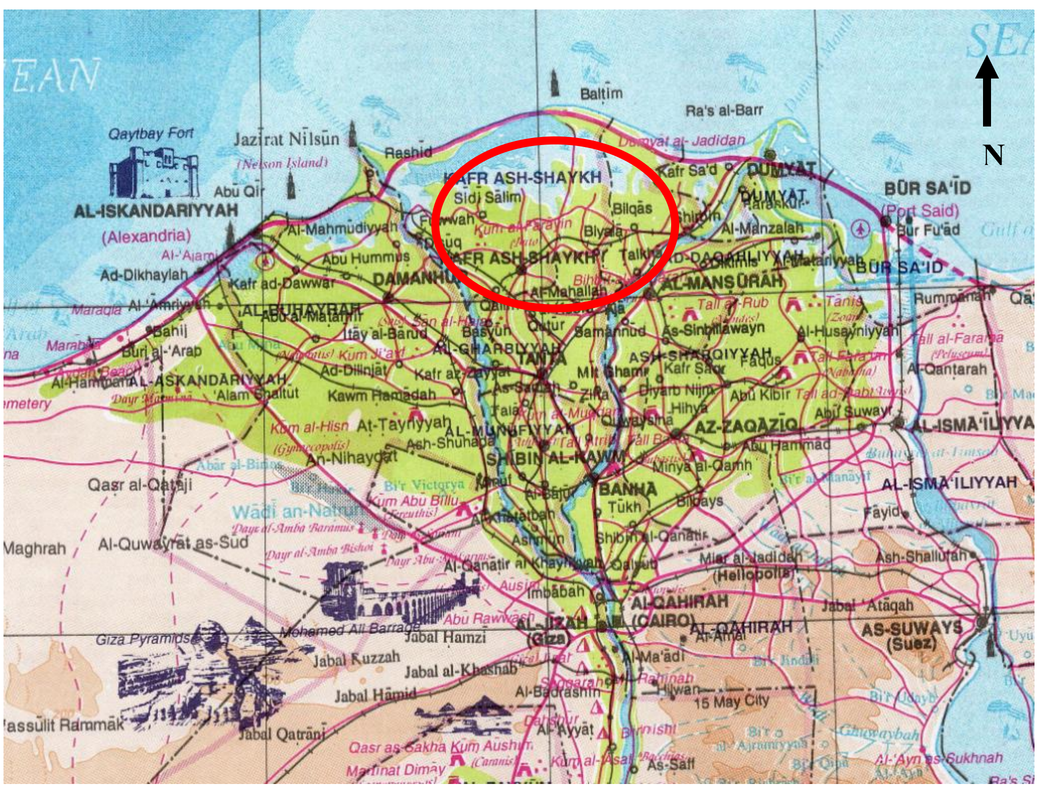



**Fig. 6: The Nile Delta**
(Source: GTZ. Original source unknown.)

Its area covers 3467 km² and is characterised by mostly flat agricultural land, with a high water table, which tends to be a problem when considering the options for sewerage. The governorate furthermore is characterised by low annual rainfall of about 100 mm per year, which is high rate of precipitation when compared to other areas in middle and southern Egypt (Eco Con Serve, 2007).

The governorate comprises ten merkaz[23] which comprise 208 villages, mostly of rural character. CAPMAS (2010) data from 2009 lays out estimates, showing that about 23% of the population of Kafr El Sheikh lives in urban areas, while the rest lives in rural agglomerations. Population ranks between 1,000 and 10,000 people in each town or village, and up to 50,000 or more in each city.

As described in previous chapters, the drinking water supply is generally well established in urban and, recently also, in rural Egypt. Facilities of wastewater collection and treatment, however, are weak or non-existent, and mainly in rural areas, connection rates to wastewater services are significantly low. Some households in Kafr El Sheikh have water-flushed sanitation, but most are not connected to any kind of sewerage. These households in most cases discharge their wastewater to cesspits, and some to a nearby drain. Average water use is in the range of 90 to 140 liters per capita per day.

Table 5 shows the connection rates to collection networks[24] in Kafr El Sheikh in each merkaz for 2009.

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[23] A "merkaz" is an administrative district. One merkaz holds several cities and villages.

[24] Note: As described in previous sections, a collection network is not necessarily connected to a WWTP.

**Table 5: Coverage of collection networks in the administrative districts (merkaz) of Kafr El Sheikh (2009)**

| Merkaz | Connection rate | Merkaz | Connection rate |
|---|---|---|---|
| Baltim | 39% | Mutubes | 27% |
| Hamul | 35% | Fuwa | 45% |
| Riyad | 34% | Desouqe | 52% |
| Sidi Salem | 32% | Qilin | 26% |
| Biyala | 33% | Kafr El Sheikh | 19% |

Source: KWSC

The resulting average coverage for Kafr El Sheikh Governorate, including both villages and cities of urban character, according to data provided by KWSC, is 34.2% for 2009.

According to information given in the NRSS, in 2002 Kafr El Sheikh Governorate counted about 300,000 buildings in villages (!), out of which 15% were connected to a sewer network, 77% had some kind of on-site facility, and 9% had no facility at all (open defecation). CAPMAS (2010) data estimates that 21.3% of total households were connected to public sewer networks, referring to a population census in 2006.

## 5.2 Overview of the GTZ project

It was emphasised in previous sections that wastewater services cover only part of the country, and rural Egypt is particularly not well served. Small communities are threatened by the consequences of poor sanitation, such as contamination of

groundwater and related health risks, which in many cases is worsened by a high groundwater table.

To combat this situation, GTZ, which contracted RODECO Consulting GmbH as an implementing consultant, assists with the implementation of decentralised sanitation systems in such un-served communities in the governorate of Kafr El Sheikh since 2002.

Before the start of the project, the sanitation situation in the villages was of low standard. In most cases inhabitants were using cesspits, which weren't emptied on a regular basis and hence over spilling, leading to wastewater in the streets, and therefore imposing a high health risk to the inhabitants. The introduction of decentralised systems in un-served communities is seen as a fast, simple and effective solution to overcome the low sanitary situation.



**Fig. 7: Over spilling wastewater in El Moufty El Kobra (Sidi Salem district), Kafr El Sheikh Governorate, before implementation of a decentralised sanitation system**
(Source: GTZ)

This sanitation system of GTZ – in the following “GTZ model” – is planned to serve villages between 1,000 and 5,000 inhabitants.

GTZ thereby follows a new approach for Egypt, which is firstly, the introduction of decentralised systems in the country, secondly, a community based approach, which sets the precondition that the respective community in first place requests the implementation of such system (bottom-up approach), provides the land needed for the WWTP and pumping station (where required), and finally, commits their responsibility for management and finance of the system, including full financing of costs of O&M. Participation plays a major role in the set up. The Kafr El Sheikh Water and Sewerage Company (KWSC) represents the counterpart.

Together with the different stakeholders, technical solutions, financial and management systems were developed and selected, taking different options into account. The following are the selected options:

**Technical system**

Since the systems are decentralised, one system serves only one village. As such, the system consists of a collection network and treatment plant.

As for collection works, either traditional / conventional gravity networks or small bore sewer systems are chosen to be implemented. As for the treatment plant, it was concluded that the best solution is the implementation of waste stabilisation ponds, consisting of anaerobic, facultative and maturation ponds, and sludge

drying beds. This selection was made mainly because such a system is simple to operate and doesn't require skilled supervision[25].

(Where necessary) collected wastewater is pumped from a pump station to the treatment plant, where it undergoes primary and secondary treatment. The effluent is finally discharged into a nearby drain, fulfilling the effluent discharge standards embedded in law 48/1982 (Concerning the protection of the Nile River and Waterways against pollution)[26].

**Management of Operation and Maintenance (O&M)**

The community represented by the CDA manages the system, and hence the CDA is the principal service provider. It contracts an operator from the private sector on behalf of O&M. Construction works supervision and technical advice is provided by the consultant (consultant for the design of the system), overall supervision of all activities (supervision of design, construction works, etc) and monitoring is handled by KWSC. The governorate is providing the legal framework, whereby the Local Village Unit is foreseen to support in the management and legal enforcement. Figure 8 provides and overview of the management.

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[25] The chosen systems are not going to be described in detail. This would be beyond the scope of the study. For further information, see Wehrle, et al., (2007).

[26] The WWTP's capability allows an effluent's quality, that theoretically would allow the re-use of the treated wastewater, as it fulfills the standards given in the guidelines of Law 44/2000. However, currently the treated effluent is not yet re-used, but simply discharged into a nearby drain. This is due to the fact, that re-use of treated wastewater is not yet common in Egypt.

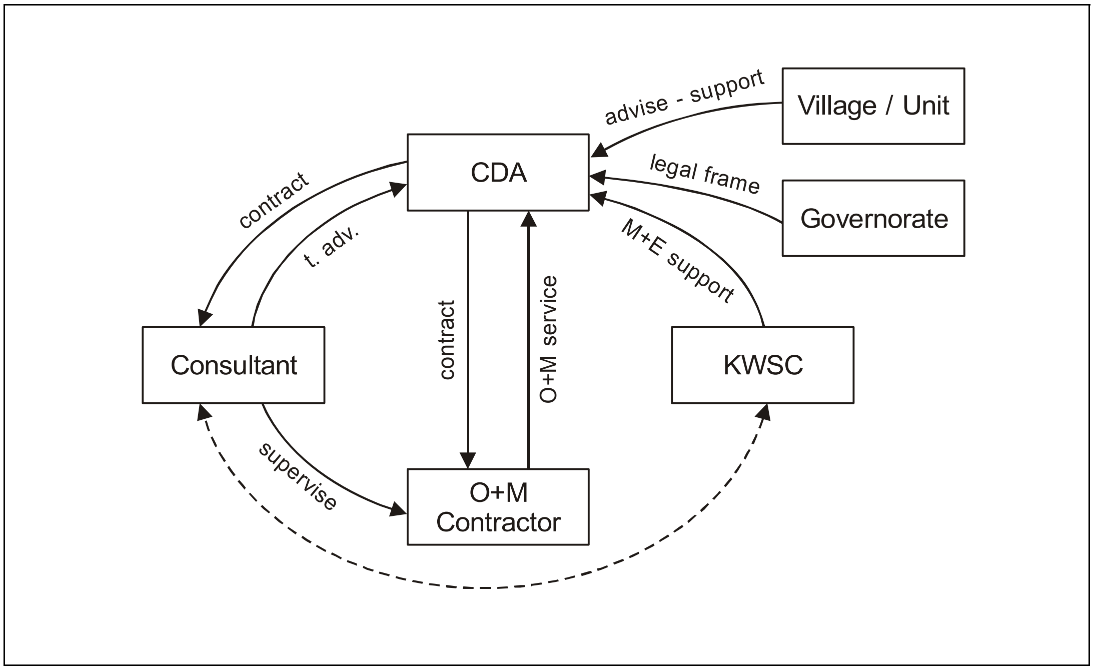



**Fig. 8: Management model for O&M of the sanitation system (GTZ model)**[27]
(Source: Wehrle, et al., (2007, p. 27))

**Financing of the system**

It was decided to introduce a monthly service charge per household on a flat rate basis, whereby the tariff is equal for each household[28], as each household size is said to be similar. The CDA collects the monthly fee from each household, transferring the money to a project account, which is monitored by GTZ and the Ministry of Social Insurance and Social Affairs.

To date, the system has been established and operates in three villages. Moreover, four villages' systems are expected to begin operation by the end of 2010 and

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[27] Note from the author: M&E= Monitoring and evaluation; t. adv.= technical advise. Contract between the CDA and the consultant for design in order to assure acceptance of the CDA as the principal client (to be facilitated by giving the CDA a voice in the selection and signature in contracting and payments etc.).

[28] "Household" refers to each married man and his family.

beginning of 2011 respectively, and tendering for the construction of another three villages is already underway.

Table 6 gives an overview of the villages which already have or will have a GTZ model.

**Table 6: Overview decentralised WWTPs (GTZ model).**

| Village | District | Status / comments | Design popula tion | No. of House holds | Wastewater flow Q (m³/day) | Source of funding | Costs[29] (mio. LE) |
|---|---|---|---|---|---|---|---|
| El Moufty El Kobra | Sidi Salem | Operational | 4250 | 420 | 316 | GTZ | 2.1 |
| Om Sen | El Reyad | Operational | 4000 | 500 | 300 | SFD | 3.3 |
| Koleaah | El Hamoul | Operational | 2310 | 200 | 173 | SFD | 2.6 |
| Om Shour | El Hamoul | Operational beginning 2011 | 2890 | 300 | 320 | GoE | 5.3 |
| Handakokh a | El Hamoul | Operational End of 2010 | 3607 | 300 | 270 | GoE | 3.9 |
| Kafr El Gedid | Kafr el Sheikh | Operational beginning 2011 | 5120 | 355 | 385 | GoE | 5.8 |
| Kouzman | Keleen | Operational Beginning 2011 | 6854 | 400 | 514 | GoE | 5.7 |
| Kheregin 3 – El Fayrouz | El Reyad | Tendering | 3607 | 500 | 270 | WB | 7.12 |
| Kheregin 5 – Om El Koraa | El Reyad | Tendering | 4330 | 1000 | 325 | WB | 7.34 |
| Kheregin 6 – El Kadesaya | El Reyad | Tendering to start | 2886 | 420 | 216 | WB | 7.5 |
| K1 | El Reyad | Outside WB area - Funding not secured | | | | ? | |
| K7 | El Reyad | Outside WB area - Funding not secured | | | | ? | |
| ? | | Village not yet chosen | | | | WB | |
| ? | | Village not yet chosen | | | | WB | |
| ? | | Village not yet chosen | | | | WB | |

Source: RODECO, Implementation Schedule, status September 2010

[29] Where system is operation, actual costs are quoted. Where planned constructions are tendered, estimated costs are quoted.

## 5.3 Analysis of key stakeholders and their roles and responsibilities

In this chapter, stakeholders, which are important for this study, as well as their roles and responsibilities in regard to the GTZ project will be described.

### 5.3.1 German Technical Cooperation (GTZ) / RODECO Consulting GmbH

For the pilot project in El Moufty El Kobra, the GTZ provided technical as well as financial assistance. For upcoming GTZ model construction projects, GTZ continues provision of technical assistance and supplies the planning costs and design, at the same time GTZ assists in obtaining investment funding for replication of the model in other villages.

RODECO is in charge of implementing the project. The project team is thus located in Kafr El Sheikh.

### 5.3.2 World Bank

The World Bank provides fund for planned GTZ model construction projects[30]. For further constructions, World Bank funding is likely to be linked to a joint project with the GoE, the "Integrated Sanitation and Sewerage Infrastructure Project" (ISSIP). This project and the role of the World Bank will be described in the following section, as its understanding is important regarding later chapters[31].

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[30] Note: This funding is not identical with the one of the ISSIP.

[31] Source of information:
http://www-wds.worldbank.org/external/default/main?pagePK=64193027&piPK=64187937&theSitePK=5236

The joint project consists of three components out of which Component 1 "Provision of sanitation systems within selected drainage sub-basins" includes the loan for the construction of the GTZ-implemented decentralised sanitation systems:

Component 1 consists of four sections (a, b, c, d), and section c) consists of the construction of the "GTZ Pilot decentralised systems". The total amount for this section counts USD 10 million; portion of the International Bank for Reconstruction and Development (IBRD) is USD 7 million, of the GoE USD 3 million.

ISSIP is restricted to the area of the Mit Yaseed and Mahmoudeya irrigation canals, located in the Nile Delta. The project developed out of an irrigation project, aiming at improving the water pathways and consequently the quality of irrigation water in this area. Due to the fact that in many cases the population dumped their wastewater into these water pathways, it became – amongst other reasons – necessary not only to upgrade irrigation canals, but also to serve the area with treatment facilities. Out of this interdependent situation the ISSIP project developed, whereby the two command areas – Mit Yazeed and Mahmoudeya – were kept. Kafr El Sheikh Governorate can be partly found within the Mit Yazeed area. Within this overlapping zone, the World Bank is already funding construction of the GTZ model.

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79&menuPK=64187510&searchMenuPK=64187283&theSitePK=523679&entityID=000333038_20080306034001&searchMenuPK=64187283&theSitePK=523679 (retrieved 13. October 2010).

### 5.3.3 Holding Company for Water and Wastewater (HCWW)

At the national level, HCWW is responsible to manage and operate water and wastewater utilities. Regarding the project, HCWW plays indirectly an important role as due to its establishment in 2004 the roles and responsibilities of its affiliated companies, including KWSC, are supervised, and so performance is improved.

### 5.3.4 National Organisation for Potable Water and Sanitary Drainage (NOPWASD)

Regarding the institutional set up and related tasks and responsibilities, it is the task of NOPWASD to plan, design, build and supervise water and wastewater facilities as well as their networks in rural Egypt. Looking at the implementation of the GTZ model, however, NOPWASD didn't have any influence or supervision. So far, as for the GTZ project, it simply transferred the lump sum of LE 20 million provided by the GoE for replication of the model.

### 5.3.5 Egyptian Water and Wastewater Regulatory Agency (EWRA)

The general role and responsibility of EWRA was described in chapter 4.5.3. Since the EWRA was relatively recently established and has been performing since 2007, the Regulatory Agency has not yet to play a role regarding the GTZ sanitary project. However, since a new policy is coming up, which will give EWRA greater responsibility and power, it is expected that in the near future, EWRA – at least theoretically – may have an interest and therefore influence on sanitary projects in general, especially regarding the set-up of tariffs. In this

respect, the EWRA is mentioned at this point, and interviews with EWRA representatives have been conducted. Results will be presented in later chapters.

### 5.3.6 Kafr El Sheikh Water and Sewerage Company (KWSC)

The general task of KWSC is to review projects proposed by governmental or non-governmental programmes, to manage and follow up on them and to coordinate the planning, implementation and operation of each phase. Also included is the collection of user charges.

Referring to the GTZ model, KWSC is the main project partner, and in this regard, the company is involved in planning and management as well as being responsible for monitoring and supervision of all related activities. What is more, KWSC has the leading role in tendering, evaluating the tenders and selection of the contractor for construction. Concerning its relationship with the communities, one major role of KWSC is to provide technical support upon request.

The approach of the GTZ model implies that management tasks are delegated to the community, which also takes care of the financing of the system, i.e. collection of the user charges. In this regard, it can be stated that KWSC is relieved of some of its burden, and that the approach assures KWSC's self-sufficiency as pertains to coverage of costs of O&M[32].

It must be noted that KWSC is foreseen to take over the role of GTZ or RODECO respectively after the agency's exit from the project. However, currently KWSC

[32] See section 4.5.3.

does not have the capacity to do so. Explanations will be given in the upcoming chapters.

### 5.3.7 Kafr El Sheikh Governorate

The governorate provides the legal framework and political support. According to Wehrle, et al., (2007) the government theoretically is also responsible for securing the required services on the governorate level or at least to assist the community to develop and improve infrastructure and environmental conditions in coordination with different departments or organisations in the governorate. Additionally, the governorate offers a yearly budget to each village to improve services and environmental conditions in the villages.

Looking at the project, the governor of Kafr El Sheikh favours and supports the GTZ approach. In this regard, he ensures that the KWSC fulfills its tasks, and wants to support villages which are unable to afford providing the land required for the establishment of the WWTP.

### 5.3.8 Rural Sanitation Unit (RSU)

Following the advice of GTZ, which was further promoted by the World Bank, KWSC has recently established a Rural Sanitation Unit (RSU). The RSU is responsible for all aspects of rural sanitation, including centralised, clustered, decentralised and private and institutional systems.

As for the GTZ model, it was recommended to establish a team within the RSU which will work permanently with the project team so as to familiarise itself with the approach, and to be capable to take over the role of the leading support agency

after its exit. So far, the KWSC employed four civil engineers on a permanent basis, who are involved in the most necessary steps of project implementation, including design details and approvals, site supervision, contractor's payments and problem solving.

### 5.3.9 Local Village Unit (LVU)

The Local Village Unit (LVU) is the lowest level in Egypt's local administration system; it represents the governorate office for a cluster of specific villages. Generally, the LVU offers all services to communities in its cluster and coordinates with the relevant departments in the governorate. It is important to note that the LVU is an administrative means that delivers the central government's services on the local level. This doesn't imply, however, political decentralisation. As for the project, the LVU is the responsible administrative body for the CDA. The LVU monitors the CDA's operational and financial performance, and according to Wehrle, et al. (2007), carries out financial audits of the CDA's accounting as well as monitors annual and monthly budgets. In this way, LVU also supervises private sector O&M services, including their billing. In addition, the LVU offers support for communities' requests, mainly regarding legal matters (e.g. pursuing bad payers).

### 5.3.10 Private Sector

The private sector includes the following actors:

Local constructor for O&M works, local construction company for the construction of the system, local consultant for overall design and supervision.

### 5.3.11 Community Development Association (CDA)

Generally speaking, a Community Development Association (CDA) is a non-governmental organisation (NGO). It is entitled to carry out numerous tasks within the community, and in this regard, has the right to administer village activities, including the collection of money and employment of staff. However, it has no legal power to pursue bad payers or violating acts. For this task, it must request support from the LVU. In respect of the project, the existence of a CDA is one precondition; where not existing, a CDA must be established. The CDA is invited and obliged to participate in all steps of the project, including selection of technology, contracting, and supervision and commissioning, and has to inform and consult the community. Furthermore, the CDA has to assume administrative and financial responsibilities, and finally takes charge of the system after its construction. Moreover, it must coordinate with the different stakeholders, and has to deal with users, especially regarding proper use of the system.

### 5.3.12 Village community

The community is the target group as well as the main beneficiary of the project. In this regard, it is important that the community expresses its need to implement a sanitation system in the village. Villagers should attend awareness activities and related workshops so as to get a holistic idea of the concept. Furthermore, they should nominate representatives to the village committee, which then form the CDA. After agreeing on the project and construction of the system, villagers must pay the monthly service charge. They should use the system in a proper way and report in case of malfunction.

What is more, existing Water User Associations can also be recognised as stakeholders, as they participate in communication and information distribution activities.

## 5.4 Main difficulties and limitations faced by the project

In the following section, the main difficulties and limitations faced by the project during and after implementation of the decentralised WWTP and its sewer network will be described and discussed. The main source of information for this section 5.4 is based on reports and project documents as well as information and statements given by experts during consultations and interviews. This paragraph aims at accentuating the main factors for constraints regarding the implementation as well as further replication of the approach. The subsequent section "Outcomes of the interviews" illustrates the perception of different stakeholder groups and relates them to what is described in section 5.4.1.

### 5.4.1 Decentralised sanitation systems – a new approach for Egypt

The GTZ model was one of the first decentralised sanitation systems introduced in Egypt in 2002. Another decentralised WWTP, which already existed at that time, was implemented by a project of the Egyptian-Swiss Development Fund (ESDF) in the village of Kom El Dabba / Quena governorate, in Upper Egypt; it was launched in 1999 and went into operation in 2003.

Thus, it can be stated that the concept of decentralised systems was (and still is) new to Egypt. Hence, the idea and the necessary approach were new to the

government; in the context of the GTZ model, it was new to the governorate of Kafr El Sheikh, including KWSC, as well as to the communities of the villages.

This situation, amongst others, originates the relatively long start-up phase of the pilot project in El Moufty El Kobra. It took three years from formulation, preparation until implementation, and finally, running of the first sanitation system. The preparation phase, including awareness activities and conduction of surveys, especially occupied quite a significant amount of time. The actual technical establishment of the system, however, was finished in just six months.

Although in other villages the GTZ model was established in a shorter period of time, some of the reasons causing the relatively long start-up phase in El Moufty El Kobra were also encountered in these villages, and will thus be described in the following paragraph.

**Attitude of CDA / villagers**

The ESDF and GTZ models are similar regarding their set up. There is just one major difference: the way in which the system is managed. In Kom El Dabba, the CDA is the responsible body for O&M, meaning it hires all necessary parties, providing a monthly salary. For the GTZ model, GTZ set as a precondition that the CDA must hire an operator for O&M. This precondition was set due to the problems the CDA of Kom El Dabba faced as a result of being responsible for O&M.

Besides this point, the CDA in Kom El Dabba can be described as very "strong". The association was established long before the project was launched and performed its role actively. It had undertaken several social projects in the village,

and even had its own bank account, out of which the CDA - actually the population of Kom El Dabba as represented by the CDA - itself donated a share for the sanitation system. This strength and experience, however, cannot be expected from every CDA, especially as in many villages a CDA has yet to be established.

Hence, the following is to highlight: The village of Kom El Dabba is situated in Upper Egypt. Generally speaking, there is a difference between Upper Egypt and Lower Egypt regarding people's attitudes, especially towards projects which require self commitment, meaning that commitment in Upper Egypt is usually said to be stronger. This situation is because Lower Egypt is closer to the administrative center, located in the capital, while Upper Egypt is more remote. Hence, the GoE over the last decades has focused more on projects in Lower Egypt. Thus, the population of Upper Egypt is used to administering works that are relatively independent and as a result has a strong set-up of own initiatives – one example is the CDA in Kom El Dabba; and consequently is highly devoted to a project regarding its sustainability, as people are not used to receiving external support. In Lower Egypt, on the contrary, people are accustomed to responsibility being in the hands of others, and hence do not have such a sense of common works.

This instance can be seen as a constraint, and furthermore can be named as an additional reason for the long start up phase in El Mofty El Kobra, as not only the government, but also the villagers had to be introduced in such a new approach of shared tasks and responsibilities.

**Reservations from governmental side**

The above-mentioned situation can also be seen as a reason for other difficulties: In particular, when examining the first constructions built, reservations from the governmental side towards GTZ's approach are palpable. The responsible bodies distrusted the idea (and partly still do not trust, as will be described in later chapters) that a village community shall be solely responsible for a technical facility, i.e. to manage, run and maintain it. Moreover, as responsibility is to transfer to the village community, one can make the assumption that fear of losing employment and power played a role, as well[33]. Especially KWSC saw itself confronted with a new, and moreover, restricted role, and the concept was new to them. So – referring to what was described in section 4.3 – it is most probable that reservations arose, as employees are against changes because they believe in certain structures and procedures that they are used to; and any change is likely to be perceived as a threat.

Despite these reservations, the pilot project was accepted. Taking the situation described by Hvidt (2004) into account that the Egyptian government relies on and therefore accepts projects proposed by donors[34], this may also have played a role, especially when considering that the GoE was not asked for a monetary contribution.

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[33] See section 4.3. However, during some consultations the respective interview partners mentioned that fear of losing power apparently doesn't play a role, as villages are, in any case, small, and as it was presented to KWSC that their role is not cut but burden is taken from them.

[34] See paragraph 4.3.3.

### 5.4.2 Financing

GTZ maintains as a precondition that the respective village community carries (at least) O&M costs, and ideally also reinvestment costs (costs of "rehabilitation"). It is furthermore required that every citizen has to contribute, meaning even poor community members, as well. However, it is left to the particular CDA on how to deal with community members who cannot afford the user charge (e.g. through the establishment of a social fund)[35]. Yet the communities are not in charge of carrying the initial investment costs of the system, but they are asked to provide the land required for the WWTP, which amounts to about 10% of the investment costs (Wehrle, et al., 2007).

In El Moufty El Kobra currently a LE 7 flat tariff is billed per household per month; in Om Sen and Koleaah LE 10. According to a study for El Moufty El Kobra conducted in 2007 by a finance expert, LE 20 is required to recover capital costs. Of course, this number is not valid for recently upcoming projects, taking their tremendously high investment costs into account. O&M costs are covered through LE 4.5. This means that the tariffs given (LE 7 and LE 10 respectively) cover O&M costs and allow savings for reinvestment costs.

The initial investment costs[36] for the pilot project in El Moufty El Kobra were provided by GTZ. For the following projects, however, construction costs are to

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[35] The following explanations do not intend on providing detailed information about performance of service or related activities (e.g. collection of fees, handling of bad payers, etc.). This would be beyond the scope of this study. For further information, see Wehrle, et al., (2007).

[36] The initial investment costs consist of the sewage collection system, including interceptor tanks and / or manholes, pumping stations if required and the treatment plant, which includes basins.

be provided either by the Egyptian government or any other donor, with GTZ supplying the costs of technical assistance, planning and design.

At present, with the financial support of the GoE and the Social Fund for Development (SFD), the GTZ model was replicated in six villages; for a (not yet defined) number of projects funding will provided by the World Bank. For further projects, however, funding is currently not secured.

**Funding by the Egyptian government**

So far the Egyptian government, meaning MoHUUD via NOPWASD, provided a lump sum of LE 20 million for the replication of the GTZ model. This amount will not last for ad infinitum; in fact just four government-financed systems were established within the range of this amount. It must be highlighted that this financial contribution from the government on the one hand demonstrates a change of attitude towards the project. On the other hand, the question is why the Egyptian government, through its concerned institutions, is not (yet) ready to further provide financing, especially when considering that the system is in line with the government's commitment to IWRM (see section 4.3). When the question was evoked during consultations, the experts said that it needs further effort and communication on a higher level to demonstrate the (positive) results of the systems.

However, it must also be mentioned that the GoE will indirectly be financing the project due to its project with the World Bank (ISSIP), which provides USD 10 million for the replication of the GTZ model, out of which USD 3 million are given by the GoE.

Still, the question remains why there is no direct funding and whether there will be direct funding from the government after the completion of ISSIP. One probable answer may be that the government is favouring the centralised "cluster" systems, as described in paragraph 4.5.4.

**Funding by the World Bank**

The replication of the system in some other villages (number yet to be defined) will be funded by the World Bank. However, funding from the World Bank is restricted to a certain area, which covers only a limited part within the Kafr El Sheikh governorate[37]. This regional restriction is a further limitation to the project; for planned constructions in villages outside this area, funding is (currently) not secured.

Table 6 (see above) shows all sites in Kafr El Sheikh where the GTZ model is established, under construction, or going to be established. It can be seen that all planned installations are going to be funded by the World Bank – except the ones outside the World Bank command area of Mit Yazeed / Mahmoudeya[38].

The table shows furthermore that costs of construction are rising. Compared to the costs of the first treatment plant in El Moufty El Kobra, the calculated costs for the new plants are tremendously high.

One reason for the rising costs may be inflation in Egypt; especially prices for construction materials and labour work, which have risen in the past years.

However, the quadruplicating of the prices cannot be explained only by inflation.

[37] See paragraph 5.3.2.

[38] See also Appendix A.

Hence, there must be other reasons, too. When being asked for their opinion regarding the high prices, experts during consultations said that one reason may be found in the number of constructions currently being undertaken, meaning the market is quite saturated. Due to this, construction companies are “not in a need” for this project and just test the market for opportunities and offer high prices since they can afford not to win the tender.

Another reason is due to the likelihood that construction companies now, as the World Bank is funding the project, abuse the market and the situation, as for them, “World Bank equals a lot of money”. This point must be taken into consideration and further investigation is required[39].

However, no matter what the actual reasons are for the present high costs – this point must not be uniquely seen as a limitation to the project, but as a threat which can result in its abandonment.

**Further remarks regarding financing**

As a matter of fact, population growth in Egypt is relatively high[40]. Sanitation projects, whether decentralised or centralised “cluster” systems, can hardly keep pace with the growing demand. Funding is therefore a major constraint, and in the

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[39] It was planned to investigate and compare the market prices for construction works and materials from 2002 until 2010 so as to find out differences in costs. Unfortunately, CAPMAS could only provide data for 2008 and 2010 respectively, but not for previous years. It was not possible to collect this information within the timeframe of the study. However, it is to recommend investigating this issue, also considering the impacts of the financial crisis.

[40] See chapter 4.

long run, neither donor funding nor contributions from the government can supply the initial (major) costs. As a result, the problem of tariffs must be mentioned.

As described in previous paragraphs, the GTZ model established user charges which cover O&M costs and allow savings for costs of rehabilitation.

When looking at national level, this kind of user charge is even an exception. User charges in Egypt are generally not sufficient and are far from reflecting the real value[41]. The GoE is highly subsidising (not only) water and wastewater services; to be sure, in 2003 the deficit attributed to the water and wastewater sector was USD 1.3 billion (MED EUWI 2, 2009). Although in many cases service costs for water supply are covered via user charges[42], this fails to account for wastewater services (Badran 2010) and a tariff system as given by the GTZ model is an exception.

In order to be able to provide sanitation systems and to cover rural Egypt, a change in the tariff system is necessary[43]. The exploding costs for construction works underline this need, and it becomes obvious that it is essential to review existing structures, i.e. to make the population at least bear the expenses of O&M, and preferably also share in initial investment costs.

Key terms in this regard are “affordability to pay” and “willingness to pay”, with “affordability to pay” as “[…] the upper limit a household can pay without

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[41] See paragraph 4.5.2.

[42] At least theoretically. Practically the tariff system lacks collection of fees (MED EUWI 2, 2009).

[43] It is not possible within the framework of this study to delve into the subject of tariff system in depth. For further information, see MED EUWI 1 (2009), MED EUWI 2 (2009), Badran (2010).

undermining the ability to pay for other vital goods and services." (Badran 2010, p. 42). Some surveys have been conducted in order to find out people's willingness to pay. Results show that users are generally ready to pay higher tariffs for wastewater services, either to be connected or, where connection to service is already established, for better (reliable) services (MED EUWI 1, 2009; Badran 2010).

In this regard, interviewees of this study have been asked about this concern, and results will be presented in later sections.

### 5.4.3 Commitment of the Kafr El Sheikh Water and Sewerage Company (KWSC)

Upon examining the pilot, it can be said that KWSC, which is actually the main project partner, failed to show strong commitment towards the project. There was little interest, especially regarding the decentralised approach. This limited interest led to the following difficulties:

Firstly, although representatives of KWSC were participating in workshops, their active contribution was little, which in turn, led to a lack of commitment. Secondly, according to the project agreement, KWSC, as the major counterpart, should have allocated engineers or specialists who would have been the direct contacts for villagers' requests. This didn't occur at the time of implementation of the GTZ model in El Moufty El Kobra. Furthermore KWSC left some of its duties unfulfilled; e.g. accomplishments of tenders, which are under the responsibility of KWSC, were partly unsatisfying. Also, regarding the tender in the pilot village, there was even need for re-tender, since the first tender was forged; or in some

cases, invoices of construction companies haven't been paid on time. Searching for explanations, it must be reviewed what has been described before: The idea of a decentralised WWTP was relatively new to Egypt, as was the GTZ approach, with regard to not only to invite the village community to participate, but moreover handing over responsibility for management and finance. That in turn may have caused KWSC's limited interested, as they perceived their competencies as being reduced. Moreover, underdeveloped institutional structures which are currently in the process of reforming may also play a role.

This attitude, however, apparently has changed and KWSC is now performing its role and is demonstrating commitment. According to what was said during consultations with experts, this change occurred for the following reasons: Firstly, the establishment of HCWW in 2004, due to which all entities have been transferred to public companies, and which moreover paved the way for the establishment of a new, better-organised management. However, this development did not transpire in 2004, but HCWW needed some time to establish itself. Secondly - and of great importance - communication between the project team and KWSC improved. This led to an improved relationship resulting in trust and rising interest towards and hence support for the project. Last, but not least, knowledge gained during the establishment of the first projects led to a better understanding of the project idea and helped to overcome prejudice and fears.

According to project's documents, the new management is now aware of the advantages of the project, and hence cooperation has improved. New counterparts, i.e. the requested direct contact persons, have been appointed, and

they receive better salaries, are well trained and are apparently quite motivated – this also reflects improvements related to institutional reforms. The “new” counterparts, civil engineers, are involved in design and approval, site supervision, payment of contractors and problem solving.

However, it is imperative to mention that the governor of Kafr El Sheikh apparently plays quite an important role as he highly favours the project and “pushes” KWSC activities. In this way, he can be seen as a key actor, and the question is how the relationship will develop once this key individual is replaced, retired, or simply no longer in the position for whatever reason.

### 5.4.4 Commitment of village community

For the pilot project in El Moufty El Kobra, i.e. for introduction of the decentralised sanitation system, it was necessary to follow a top-down approach. For the following villages, however, a bottom-up approach was achieved. Village communities expressed their needs and asked for the implementation of such a system in their village - well aware that they have to provide the land and finance for the system. In this regard, project’s documents state that communities generally are motivated and highly committed to the project and developed a sense of ownership.

Yet, constraints need to be highlighted. One major constraint currently faced is the misuse of the collection system by villagers. Apparently many villagers use dispose animal manure into the system, which consequently overburdens the treatment plants capacity, so that the effluent doesn’t meet planned, and

moreover, required parameter quality limits[44]. This happens notwithstanding that villagers are informed about how to use the system in a proper way. Hence, it can be said that commitment is limited, at least partly.

In this context, a further constraint must be mentioned, which is the handling of this particular situation. As it is related to the legal context, this constraint will be described in the upcoming section 5.4.6.

### 5.4.5 Land requirement

Land is very precious not only in the delta region, and land requirements are a limitation to the project. Some villages cannot afford to provide the land as required by the project, and it must be investigated how to overcome such situations when this occurs. Even if one criterion of village selection is that the community's main contribution to the project is the provision of land, such criterion should not lead to the exclusion of a village.

Here once more, the governor of Kafr El Sheikh plays quite an important role: in order to alleviate this constraint, he offers the provision of the necessary land, i.e. offers funds to buy the land. This dynamic, however, is twofold: On the one hand, it illustrates the strong commitment and support of the governor and the governorate respectively. On the other hand, it is questionable to what degree this will affect villagers' attitudes. As described in the previous paragraph, some villagers already do not demonstrate a sense of ownership (by misusing the

[44] The problem of misuse appeared recently. Investigations are just undergoing, so that there are no data to frequency, number of misusing households, etc. In fact, there is not yet proved evidence that the bad effluent quality is due to misuse of the users.

system), which may become worse in case they are provided with land, and hence do not have to pay for it.

### 5.4.6 Legal framework

There are some "uncertainties" regarding the legal framework of the overall project and its related factors.

**Legal basis of the CDA**

CDAs are defined in detail by decree no. 178/2002 of October 23rd 2002, embedded in Law 84/2002, on "Non-Governmental Societies and Organisations", issued by the Minister of Insurance and Social Affairs. According to this decree, associations, and therefore CDAs, have the authority to work on different activities for the development and improvement of their particular village (Article 48).

According to Article 59 of Decree 178/2002, an association may, for consolidation of its financial resources and in order to realise its social purposes, amongst others, set up service and productive projects. However, an association cannot penalise bad payers or violating acts, as it does not have any judicial authority. The required juridical body is presented by a Regional Union, and its establishment is required by Law 84/2002, Article 65. For the CDA, the responsible Regional Union is the Local Village Unit (LVU). To chase debtors, violating acts, and other issues, the CDA needs to inform the LVU.

This situation limits the power of the CDAs and has to be identified as a constraint, which can be exemplified by the following: As described, some villagers are misusing the system and dump animal manure into it. The CDA

cannot penalise the individuals who are misusing the system. Instead, it should report back to the police and the LVU, which should then take necessary action. This didn't happen due to social circumstances. The whole situation developed as a result of a big issue, as the MoHP, the responsible body for sampling[45], identified the effluent as not meeting the required quality standards, and, according to Law 4/1995 and Decree 338/1195 on Environment[46], had to panelise the "responsible" person. However, the CDA is responsible in the eye of the governmental body, in particular the head of the CDA, as the CDA is responsible for the system, and not the actual violator. In turn, the chairman of the CDA was to pay a fine and / or be sent to prison – and left the CDA.

**Legal basis of selected technology – Engineering Codes of Practice**

During many consultations it was mentioned that the small bore sewers, which are applied in some of the villages, is met with refusal. It is crucial to mention that although the construction of small bore sewers is said not to follow Egyptian standards, this is actually untrue. Rather, this kind of system is not listed in the code. This doesn't imply that its construction is illegal. However, as mentioned, small bore sewers run the risk of being rejected, especially by persons who are not in favour of the system as a whole. In this regard it can be recommended to adjust

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[45] According to different Laws, PD and Decrees on the Protection of the River Nile against Pollution & Drainage of Liquid Wastes.

[46] Main concerned Articles of Law 4/1995: Articles 69, 71, 72, 78, 79 (on Protection of Water Environment from Pollution), and Article 84 Bis (on Penalties). Main concerned Article of Decree 338/1995: Article 58.

the code so as to overcome such perceptions, which in a worst case scenario may be cumbersome.

The MoHUUD issued engineering codes of practice which regulate the engineering design and construction specifications of wastewater collection and treatment utilities. The following are the most important codes in this regard, which should be revised:

- Ministerial Decree 135/1999: Code for Design and Execution of Sanitary Appliances in Buildings. The Code, amongst others, describes necessary wastewater treatment stages, control methods and disposal alternatives.
- Ministerial Decree 286/1990: Code for Design and Execution of Water Supply and Wastewater Piping Networks, describes amongst others the pipes foundation design, design of accessories such valves, manholes, and oil traps.
- Ministerial Decree 169/1997: Code of Practice for Wastewater Treatment Works. It defines the hydraulic, construction and electromechanical design considerations.

(Eco Con Serve, 2007)

### 5.4.7 Summary

It can be summarised that the project is facing several limitations caused by both external and internal factors. Investigations found that the GTZ model's new approach was firstly confronted with reservations and lack of commitment from the government, in particular from its concerned institutions; and KWSC reservations have been said to be a major constraint. Recently, however, the

commitment of KWSC remarkably improved. Positive experiences as well as improved communication on a personal basis are reasons for this change. Thus, this former limitation seems to have diminished. However, there is a certain risk that the current situation may change in case the key person is replaced, retired, or simply no longer in his position for whatever reason.

Villagers' commitment, on the other hand, also has to be said to be partly limited, as the misuse example demonstrates. The question arises, however, whether villagers need additional and more precise information in order to better understand the system and how to sustain it, or if they are aware and simply don't care. In this regard, one must emphasise that there is a difference of commitment between communities in Upper Egypt compared to the ones in Lower Egypt: Apparently, communities in Upper Egypt are more likely to be committed towards a project due to their experience in which they have to be self-responsible – which means in turn, that communities can learn to be independent and to not only manage certain services and facilities, but also to care for their sustainability.

This first section of investigations furthermore showed that the financial situation must be seen as a major limitation, recognising also that land requirements belong to this kind of limitation. Financing of the sanitation systems, whether centralised or decentralised, is a general constraint in Egypt. Currently, different donors finance the replication of the GTZ model, with the GTZ fronting costs for technical assistance and design. The question arises about how to finance further systems if there is no more donor funding – financing therefore is not only a limitation, but its uncertainty even threatens further continuation.

In addition, the model is facing limitations related to legal uncertainties and weaknesses, which hamper fast and appropriate reaction mainly from the communities, and are likely to make concerned parties lose their trust and passion.

## 5.5 Outcomes of the interviews

In the following section, the results of the interviews conducted with different stakeholders will be presented. The interviews aim at giving an idea about how different issues related to the introduction of decentralised sanitation services, and the GTZ model, in particular, are perceived. Furthermore, interviews allowed investigating stakeholders' perception of the difficulties, which were mentioned in the previous chapter.

### 5.5.1 Perception of decentralised sanitation systems by governmental representatives

One of the first questions representatives of concerned governmental institutions were asked, was whether or not, according to their opinion, the introduction of decentralised WWTPs is a useful approach. In all cases the answers were positive, meaning that all interviewees approved decentralised WWTPs.

When asked for explanations, two points were most frequently cited: decentralised systems suit small and medium-sized villages and areas of low population density, and decentralised solutions are generally cheaper than centralised ones, especially when the particular agglomeration is located far from any other (centralised) WWTP (distance). It is imperative to emphasise that

representatives of KWSC additionally mentioned that the village community, which receives a decentralised system, develops a sense of ownership towards the system, and one highlighted in particular that it is advantageous that the community supplies the cost of O&M under the GTZ model's approach; hence, alleviates burdens on the government. Also, the EWRA representative's answer is interesting, who said that one major advantage of decentralised systems is that they are "simple" to build and to run, and so allow the utilisation of local capacities.

Regarding questions about centralised versus decentralised solutions, it emerged that all interviewees, with the exception of two, apparently favour the establishment of a decentralised solution if overall costs are equal to the centralised one. The two that presented a dissenting opinion said that the management of cluster systems is easier. One of them further mentioned that a centralised system is the responsibility of the government, while a decentralised solution on the contrary needs the commitment of the community, which is hard to achieve. This answer is in contrast to the ones given by interviewees who favour the decentralised system: They mentioned that the management of decentralised systems is easier, and moreover cheaper in the end, as O&M is managed by the respective CDA. Also, one interviewee highlighted that when there is a failure in the system, in the case of a cluster system, each village will blame each other regarding responsibility, while in the case of a decentralised system it is clear who bears responsibility. That decentralised WWTPs suit the

size of the population and can easily be adapted to a growing demand was another interesting point that was mentioned.

When asked if there would be reasons not to choose a decentralised solution, even if overall unit costs would be cheaper than the one of a central or cluster system, HCWW representatives answered that generally the cheaper solution is preferable, but all related issues must be taken into consideration. One interviewee, who reflects KWSC's opinion, said a reason not to go for the cheaper solution would be if the community does not support the decentralised solution (i.e. lack of commitment).

When asked about constraints of implementing a decentralised sanitation system, it was stated that this kind of solution requests from the public to provide land[47] – which is not the case for centralised / cluster solutions – and that this further raises the question of how to "convince" inhabitants of the decentralised system. Moreover, the proper use of the system was mentioned, meaning that the system is easily threatened by misuse. In some cases the necessity of awareness was mentioned.

Examining at the perception of decentralised sanitation systems by governmental representatives, it can be said that all interviewees seemed to be well informed about decentralised sanitation systems (in general, not specifically the GTZ model) and related aspects, and could name advantages but also disadvantages. That indicates that concerned people apparently deal with the subject, and this

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[47] It didn't become clear whether the interviewee referred to the GTZ model only, or decentralised systems in general.

furthermore implies a (positive) interest in the subject, as also shown by the answers.

### 5.5.2 Perception of the GTZ model

KWSC and the communities of El Moufty El Kobra and Koleaah were asked what they would tell when they had to describe the GTZ project in just a few sentences.

KWSC interviewees mentioned that the GTZ model fits small and medium-sized villages, that the public participates in O&M, and that communities are served, which were previously neglected. These are clearly perceived advantages. One interviewee perceived it as a disadvantage, that the community needs to understand the idea, and that the contractor for O&M must be intensively trained.

The villagers and CDAs in contrast highlighted other dimensions:

They said that the implementation of the WWTP was “like a dream that came true”. Former environmental and health threats have been eliminated; the village is clean, and there is no more sewage in the streets. Women mentioned that there is no longer a need to carry the wastewater [in buckets] away from the house.

Additionally, both CDA and KWSC, were asked if such decentralised systems should be introduced in other villages and why. All answered positively. As for explanations, they referred to the ones given to the first question. Additional reasons from KWSC’s perspective are that decentralised solutions are built faster than centralised ones, and from the village communities’, that such a system “modernises” the village. Also, it was said that the system helps the population to save money (referring to emptying of cesspits).

### 5.5.3 Improvements related to the establishment of decentralised sanitation systems

Governmental representatives were asked if and how, in their opinion, the establishment of a decentralised sanitation system improved villagers' quality of life. The answers also give an insight about their perception regarding decentralised solutions. Moreover a comparison with villagers' perception is possible, as they have been asked the same question. This allows finding out whether governmental representatives actually emphasise the same points as the actual beneficiaries.

In all cases governmental representatives are of the opinion that the introduction of the GTZ model improved villagers' quality of life. Villagers confirmed that quality of live definitely improved. Table 7 shows mentioned improvements.

**Table 7: Improvements referring to the establishment of a decentralised solution**

| Governmental statements | Nominations | Community statements | Nominations |
|---|---|---|---|
| Reduced health risks / health improvement | 5 | | 3 |
| Reduced environment threats (contamination, no sewage in streets) | 4 | | 6 |
| Houses protected from high groundwater table | 2 | | 3 |
| Improved hygiene conditions | 1 | | 1 |
| Reliefs work load (on woman) | 1 | | 2 |
| Cheaper (compared with emptying of cess pits) | 1 | | 1 |
| | | No more odour, flies | 2 |
| | | No need for trucks (emptying cess pits), independent | 2 |

(multiple answers)
Source: Own investigations

Improvement of the environment, meaning no more sewerage in the streets and reduced contamination of the groundwater, and reduced health risks were mentioned the most. These improvements seem to be the most obvious and most valued. This outcome illustrates that both governmental representatives as well as villagers know about the importance and impact of these issues, and this furthermore indicates good awareness in the community. It furthermore shows that governmental representatives highlight the same improvements as the villagers, which means that both focus on the same issues. This is very important, as both parties have the same expectations of the system and do not work in divergent directions.

Additionally, the women were asked whether or not it is an improvement that women generally do not have to leave the house anymore due to wastewater concerns. All women are of the opinion that it is an advantage that they no longer have to leave the house, stressing that there is no disadvantage whatsoever[48].

One governmental interviewee furthermore perceived the advantage that the improved quality of life in villages makes people stay and prevents migration to urban areas – and that is in line with the communities' perception that such system "modernises" the village.

[48] This question was asked, as there is the possibility that this issue is perceived as a disadvantage: Before the construction of the sanitation system, the women had to go to the river, e.g. to wash the dishes, to avoid wastewater production in their homes. Now, however, handling wastewater is no longer a problem. On the one hand, this surely is an improvement; on the other hand, there is the question of the social aspect (no more gathering and communication at the river).

### 5.5.4 Participation

Participation is seen as a key to successfully achieving new approaches. Through participation, acceptance and moreover support will be achieved, and useful and essential local information and knowledge can be collected and used (European Community Commission, 1998; Van Edig and van Edig, 2004; Gooch and Huitema 2008; Timmermann, et al., 2008). Referring to Gooch and Huitema (2008), information and its communication is very important for public participation, as this leads to informed participation. However, participation does not mean only participating with the local population as it is often understood, but also with the government and its concerned institutions (Ahlers and Ridder, 2008; Gooch and Huitema, 2008).

In this regard, KWSC as the main governmental stakeholder, as well as the village communities were asked whether or not they have been adequately involved in the establishment of the project, and if they were able to participate.

In terms of KWSC, unfortunately not all interviewees can serve as reference, as some are not involved in the project for a sufficient period of time. One of the interviewees who can serve as a reference said that KWSC in the past as well as recently is sufficiently involved in the project, and that the company gets enough information from the project team. Another, however, presented the situation in a different light and said that KWSC is not actually involved, but only performs its tasks.

As for the communities in El Moufty El Kobra and Koleaah, on the one hand, the villagers that were interviewed assured that they were involved and got enough

information; on the other hand, it shall be mentioned that in particular women answered cautiously and it felt like they did not really understand the purpose of the question. Regarding these cautious answers, the assumption can be made that villagers generally had the chance to participate, but of course, not all of them participated actively but were informed by their representatives. All mentioned, however, that there was a satisfying exchange of information with the CDAs.

The CDA representatives stated that they were adequately involved; however, in El Moufty El Kobra, one mentioned that some of his suggestions fall on deaf ears, and the chairman said that in the very beginning awareness was not as good as it is now in other villages[49].

From the point of view of the experts, involvement of both KWSC and villagers was sufficient, and participation of the community was really satisfying. It was said, however, although KWSC was involved from the beginning and was asked to participate, they did not make use of this opportunity in the beginning and showed no interest.

In sum, it can be said that GTZ, in particular the project team, informed and called for participation from the start of the first project, and involved both KWSC and the village communities. Hence, all parties were able to participate in all stages of the project, but the grade of active involvement varied.

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[49] Whereby it remained unclear whether he refers to the awareness activities of the project team, or the awareness beyond the community.

### 5.5.5 Ownership

Participation of the local community can be seen as the key to developing a sense of ownership, because only participation leads to an exchange of information and assures acceptance. Sense of ownership, on the other hand, implies sustainability of a certain project, because when people feel that they “own” a good, they have influence over it, and they feel responsible for it and consequently take care of it.

In this regard, the village communities were asked if they feel responsible for the system in a sense that it is part of the village, and hence take care of it.

In all cases the answers were clearly positive. This indicates great acceptance of the system. Yet the question arises, why villagers in this case misuse the system and discharge animal manure, as explained in previous chapters. One reason can be that villagers are not fully aware of the consequences of the misuse, and that more awareness in this regard is needed. On the other hand, this issue can be seen as an entrenched attitude, as people are not yet used to being responsible for themselves and hence are not used to taking care of public facilities.

### 5.5.6 Additional information

Related to this topic, the representatives were also asked if they need more information about the system, regarding how it works, what may harm it, etc. All interviewees replied in the negative, meaning that they need no additional information.

This shows, on the one hand, that villagers as well as the CDAs feel well informed and are satisfied with the information they received. On the other hand, these answers indicate that CDA and villagers are not aware that they still lack

information, e.g. regarding misuse of the system, or misunderstood / have a wrong perception of delivered information, e.g. regarding the perception of distribution of roles and responsibilities between CDA and KWSC (see next paragraph), or, in the worst case scenario, have the information but ignore its content.

In this regard, it is imperative to mention that some interviewees said that if there was additional information, they would be happy to know about it. This indicates acceptance and interest towards new or specified information.

### 5.5.7 Governance

KWSC staff and the CDAs were asked several questions related to governance. Questions included exchange of information, trust, and perception of each other's role in conjunction with the project.

When being asked about each other's role, it showed that KWSC staff is aware of its own, and can also name the role of the CDAs. The representatives of the CDAs, however, could define their own role, but regarding the role of KWSC, they mentioned tasks which aren't actually KWSC's remit[50].

This demonstrates that roles and responsibilities are not clear yet, especially not to the CDAs. One KWSC interviewee even expressed that roles and responsibilities have yet to be clearly defined, as the CDA is not aware of KWSC's. This situation can be seen as a constraint. Problems occur with the wrong perception of responsibilities, because concerned parties, first and foremost, are likely to

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[50] In El Moufty El Kobra one interviewee didn't give answer to this topic and said that they "have nothing to do with them".

assume no responsibility for certain issues – as they are not aware it is their responsibility, and secondly, they may not be aware of who to address for certain issues as the following paragraph proves:

Regarding questions about the relationship between KWSC and the CDAs, the answers from the CDA of El Moufty El Kobra on this topic were quite negative. They denied good cooperation with KWSC, and expressed that there is a lack of trust towards the company. Asked for reasons, they said that KWSC is unresponsive, is uniquely interested in supervising, and doesn't perform beyond this function. It must be mentioned that the CDA of El Moufty El Kobra at the time of the interview was concerned by the issue of the misuse of the system and confronted with the resulting problems, as described previously. In their point of view, it is KWSC's task to support them on this certain issue, but that KWSC fails to do so. Here, it occurs what was mentioned before: The CDA perceives it as the task of KWSC to solve the problem, and is not aware of which entity to actually address – which in this case, would be the police and the LVU, as the LVU has the right to apply the law.

In Koleaah, however, the CDA deputy chairman was of another opinion. He said that they have satisfactory cooperation with KWSC. Yet, he also said that although there is trust towards the company, in case of problems that may occur, the CDA primarily would contact the project team.

KWSC generally answered positively on this topic, meaning that they perceive the relationship to be good. However, one mentioned that CDAs only share

information when they face problems, and that they should share other (general) information as well.

To summarise, it can be said that the relationship between the CDAs and KWSC is not (yet) satisfactory developed, and obviously, it still needs more time in order to achieve a good relationship.

This situation hampers governance mechanisms. The negative perception of KWSC, for example, leads to mistrust, and furthermore withholding of information by the CDAs. Regarding KWSC, it must be kept in mind what has been described in previous paragraphs (5.5.1, 5.5.2), where KWSC staff answers expressed mistrust towards the village communities' commitment and their capacity to manage the sanitation system on their own.

The recently established RSU promises improvements in this regard, and when looking at villages where the GTZ model is newly established, it can be noted that they already benefit from the engineers who were recently employed and are in direct and regular contact with the CDA. In this regard, interviewed experts expressed that trust between CDA and KWSC developed recently, mainly resulting from the increasing activity of KWSC (employment of engineers, etc.).

This accentuates the importance of such provisions, and how it is vital to bring together village community and government, as it clearly improves trust and moreover governance mechanisms.

### 5.5.8 Financing

**Perception by governmental representatives**

It was described in previous chapters that the GoE is highly subsidising (not only) water and wastewater services, and that there is an urgent need to change the current tariff system.

The GTZ model includes a tariff system for the villages, which via user charges covers costs of O&M and future capital (rehabilitation) costs.

As it has been described, HCWW and its affiliated companies are actually required to be self-sufficient. It is the aim that the companies affiliated to HCWW be in charge of recovering O&M costs for existing and new sanitation facilities, either through direct user billing or indirectly through collection of fees via CDAs.

However, theoretically speaking, in the long run cost recovery, even of total costs, is necessary[51].

On this topic, interviewees representing EWRA and HCWW respectively were asked several questions:

- Do you have an estimate about how much money must be spent in order to cover rural Egypt with sanitation facilities?
- Do you see a need to change the financing structure – regarding tariffs – as it is now?
- What might be a likely financing model in the future?

[51] See paragraphs 4.5.2 and 5.4.2.

- So far, the GoE provided a lump sum of LE 20 million for the installation of the GTZ model. What are the reasons that there currently is no further contribution?

As for the first question, all interviewees quoted a precise amount of money (LE 80 billion as for latest calculations, respectively LE 60 billion as an older number), which is said to be necessary to cover all of rural Egypt with sanitation facilities. This number is given in the NSS, as well as in other documents available to the concerned institutions. This shows, on the one hand, that the interviewees are informed about the expenses that must be spent in order to provide sanitation services to rural Egypt, on the other hand, just two interviewees were aware that this number is roughly calculated and is likely not to reflect the real amount which is needed to be invested.

As for the second and third question on this topic, all but one interviewee expressed that there is clearly the need to change the current financing system (for whole Egypt) so as to be able to finance capital costs. Regarding measurements on how to achieve cost recovery, the following was quoted: to install meters (so as to achieve rational use of water), to develop a new billing system, to increase efficiency of meter reading and enforcement of bill collection, and moreover to raise existing tariffs. Regarding the latter, it was stated that this approach needs (social) studies, cannot happen within a short period of time, and that the financial situation of the poor population must be taken into account.

One interviewee stated that the big part of the costs should be supplied by the GoE or a donor, while only a small part should be covered via user tariffs. He

further mentioned that especially for rural Egypt, where inhabitants are mostly poor and cannot afford higher prices, the current financing system should be kept.

Concerning the last question on this topic, actually no one was able to give a real answer. It became clear that the interviewees were not concerned with the question of the governmental funding of the GTZ model, and in most cases referred to the NOPWASD, which is in charge of transferring money.

Taking the answers of the interviewees into account, it seems that the concerned governmental institutions are aware that a tremendous amount must be spent in order to cover rural Egypt with sanitation facilities. Also, they see the necessity for changing the current tariff system (whole Egypt), meaning to adjust the prices for water and wastewater services, and according to the General Manager of the Tariff and Pricing of EWRA, apparently, raising prices in the near future has been planned. This intention, however, seems to be in its initial stages, and the question is, how these adjustments will happen as well as how fast they will happen.

**Perception by village community**

Also villagers and CDA members were asked about the issue of financing, and with the help of different questions, it was investigated if there is will to pay higher tariffs in order to have a decentralised sanitation system, assuming no donor would be available.

In one of the questions, interviewees were told the amount of money which would be required if total costs of the system were to be covered. This amount was

calculated taking certain baseline data into account[52]. Calculations were made for those villages where the system is already operating. Table 8 shows the current tariff and the calculated tariffs which are necessary to cover total costs of the respective system.

**Table 8: Calculated tariffs for coverage of total costs**

| Village | # Households at base year | Investment (mio. LE) | Current Tariff (LE) | Tariff (LE) total cost |
|---|---|---|---|---|
| El Moufty El Kobra | 420 | 2.1 | 7 | 20[53] |
| Om Sen | 500 | 3.3 | 10 | 28 |
| Koleaah | 200 | 2.6 | 10 | 57 |
| Om Shour | 300 | 5.3 | 10 | 69 |
| Handakokha | 300 | 3.9 | 10 | 53 |
| Kafr El Gedid | 355 | 5.8 | 10 | 63 |
| Kouzman | 400 | 5.7 | 10 | 55 |

Source: Own calculations based on numbers given by RODECO, Implementation Schedule, status September 2010; and Report on Financing Systems, April 2007. See Appendix B.

Although the answers differ slightly, the outcome is very clear: A higher tariff is refused; if at all, only a minor rise would be accepted. It must be mentioned that it was very hard for the interviewees to imagine earlier times when there was no

[52] Calculations are given in Appendix C. The basis / sources for the calculations are declared in Appendix B.

[53] Source: Report on Financing Systems, April 2007.

treatment plant in the village (as requested by the question). Also, they hardly could imagine the absence of a donor, meaning not to receive any funding[54].
However, it is imperative to mention that mainly CDA representatives were ready to pay a higher tariff under the imagined circumstances. One of them even mentioned that because he is involved and informed about the whole process, he knows the real value of the system, and hence would be willing to pay more. He further stated that in order to make people pay a higher tariff, they need to be more aware of the system's value.
Besides, some of the interviewees referred to community members who are already hardly able to pay the current tariff, and who apparently cannot pay a higher user charge.

As a result, it can be stated that the communities apparently do not agree on financing the initial costs of such a system, neither in total nor partly. This is very understandable considering that until now such services are almost free of charge, and people are accustomed to the government bearing all responsibility and costs, as well.
It becomes manifest that if the desired changes in the tariff system of whole Egypt shall be achieved, significant effort must be exerted by the Egyptian government, with special regard to the situation of the poor.

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[54] Furthermore, it is fair to assume that villagers feared a rise of user charges when they answer positively. Both circumstances, fearing rise of user charges and absence of imagination, surely influenced the outcome, and it is of interest to ask the same question in villages where there is no treatment system yet. This was not possible within the timeframe of this study.

One important comment made by one of the CDA representatives shall be mentioned here: He stated that villagers are unlikely to be willing to pay a higher monthly fee. However, they might be likely to pay a lump sum[55]. He referred to the situation in which villagers in most cases do not have a steady income but have, related to the harvest season once or twice a year, a higher income, and during the other months, remarkably less income is available to them. Such comments should be taken into account when considering a new pricing system.

### 5.5.9 Replication of the GTZ model

Experts and KWSC representatives were asked why, in their opinion, the project concept of GTZ was not replicated more often. One KWSC interviewee could not give an answer; the others emphasised that land requirements are hindering replication, as villagers can't or don't want to provide their land. However, it was also stated that there is a will to continue the project (also after exit of GTZ).

Experts said that when looking at the communities, they express their will to have such a system and are even willing to provide land for it. Furthermore, they emphasised that public authorities increasingly support the approach. Consequently, the reason for slow replication, in their opinion, neither lies with the communities nor with the public authorities. All experts stated that the main, and maybe only reason, why the GTZ model was not replicated more often, is due to a lack of funds. However, this is indirectly related to the comments and

[55] It was unclear whether "lump sum" meant once in a while (e.g. once a year), or only once, e.g. with the beginning of the construction.

assumptions made in section 5.4.2 (Finance): 1) need for intensified communication and hence exchange of information on higher governmental levels; 2) greater interest of the government in centralised (cluster) systems.

### 5.5.10 Further comments

As described in the methodology, the interviews were openly conducted, meaning that it was possible to ask additional questions, or to take interviewees' additional remarks into account. This will be presented in the following paragraph.

The CDA of El Moufty El Kobra very much expressed their disappointment and complained that they feel to be neglected by the project team. They said that at the start of the project, the project team was present at all times, but now they regret having lost their full support.

From the point of view of the author, this demonstrates on the one hand that the CDA and the community (not only of El Moufty El Kobra) is partly unaware of the concept of the project, meaning that the project team hands over responsibility to the community, and that after exit of the external agency, the community must handle all related issues; in case problems occur, the community has to deal with them and has to address concerned institutions. On the other hand, it becomes obvious that the project team should be present over a longer period of time after the establishment and finally, operation of the system. Also, the CDA representative of Koleaah expressed this need, and said he wants the project team to stay longer so as to be able to approach them. Such a statement furthermore underlines that relationships with KWSC or other concerned institutions are not well developed, as CDAs apparently don't want to contact them, and feel that it is

more convenient to contact the project team. Apparently the relationship and trust towards the external agency is well developed, but not to governmental institutions.

Furthermore it is salient to mention that the CDA in El Moufty El Kobra complained that several parts must be replaced (broken lids, etc.), and they requested that they be replaced, but were unable to obtain funding to do so. Such statements indicate that the CDA either isn't aware that such replacements / reinvestments are their responsibility, and that reinvestments are even covered by the user charges, or that they simply don't want to spend the money[56].

### 5.5.11 Summary

The second part illustrates perceptions of the previously mentioned instances expressed by different stakeholders.

The outcomes of the interviews with different stakeholders underscore that the implementation of decentralised sanitation systems is increasingly becoming an issue in Egypt. Governmental representatives have a clear idea about decentralised solutions in general and can name advantages and disadvantages. The introduction of the GTZ model is perceived positively, and different affirmative aspects regarding its implementation were mentioned. Thereby,

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[56] During the interviews, the CDA also expressed their disappointment that at the beginning of the project they received a lot of "gimmicks" (such as T-Shirts, pens, etc.) from the project team, but no longer do. This indicates that the CDA and the community is very much used to receiving presents and the like, and moreover is accustomed to items being funded on their behalf.

governmental representatives and the communities highlight the same advantages, meaning they do not focus on divergent issues.

The outcomes furthermore show that governance mechanisms are not yet satisfactory: Although the performance of KWSC recently improved, CDAs are not content and call for better service. However, this is partly also related to the fact that the community is unaware of what the actual role and responsibility of KWSC, and thus claim that KWSC is not fulfilling tasks which are actually not under their responsibility. Consequently there is a lack of exchange of important information as well as distrust.

The issue of financing is perceived as major constraint regarding the replication of the GTZ model (also considering that the issue of land requirements is related to financing). The GoE apparently sees the necessity for changing the current tariff system and for raising user charges so as to be able to finance initial capital costs. The villagers, on the other hand, express that they are not ready to pay higher user charges in order to finance the initial costs of the construction – as such, it became unclear whether they cannot afford higher charges, or are unwilling to do so.

# 6 Embedding the results into a wider framework

It is the purpose of the study to illustrate implementation difficulties faced by the GTZ model. The investigation moreover aims to give general statements concerning the introduction of decentralised sanitation services in Egypt. This is possible, as illustrated findings are not exclusively limited to the experiences with the GTZ model but can be embedded into a wider framework. It can be stated that observed difficulties and limitations can generally be expected when establishing decentralised sanitation services in Egypt.

When concluding the previously described outcomes of chapter 5, it can be said that there are currently two major constraints, expressed in different shapes: Governance and financing.

As for governance, the first constraint, the investigation highlighted that difficulties are primarily related to the different parties' attitudes and commitment. The GoE and in particular its concerned entities as well as the communities are unaccustomed to sharing responsibilities. In Egypt, the government is typically responsible for providing and managing facilities. In the government's view, there is no or only limited trust that communities are able to take over part of these responsibilities, and in this regard concerned institutions did not support the establishment of decentralised sanitation systems, at least in the beginning of the project, and thus did not satisfactory perform their role.

However, it is imperative to highlight that the establishment of a new governmental body, namely the HCWW, brought a new structure into the water and wastewater sector of Egypt, and set connected and interlinked changes into operation, which are partly still ongoing. The roles and responsibilities of the water and sewerage companies are now explicitly defined, and the companies are increasingly accountable. The example of the GTZ model shows that the KWSC now performs its role more actively, which is expected to contribute considerably to the project's long-term sustainability – if changes are not simply related to one key person.

This emphasises the importance of structured organisation with well-defined coordination and related to this a clear distribution of roles and responsibilities. This importance is also expressed in scientific literature, and described in the theoretical part of this study.

It is important to mention that improved communication between the project team and the company led to an improved relationship and also contributed to the company's interest in and support for the project. KWSC staff now actively participates in different phases of the project, and thus, has a better comprehension about the project and related activities. If KWSC further increases its participation, it is in the best case likely to overtake the role of the external agency after its exit, and to continue the replication of the model.

Furthermore, the active performance of KWSC brings the company closer to the villages – and as a result enhances the relationship with the communities. This

moreover promotes the development of trust from the community towards the company, which then, in the best case, results in improved information sharing.
The information sharing on the other hand can also improve KWSC’s trust towards the community, and convince them of the communities’ ability to manage such an entity. That such mechanisms of exchange of information and trust building, in other words the enhancement of governance mechanisms, are currently improving is shown in the interview with the CDA representative of Koleaah, where the village already benefits from the newly employed engineers.

As for financing, the second major constraint, it can be said that the main reason for the currently slow replication of the model is the question of finance. In different chapters the matter of financing and tariff systems was presented, all resulting in the statement that Egypt has to undergo a change in its current tariff system if the country shall be covered with sanitation services – be it a centralised or decentralised approach.
In paragraph 5.5.8 (Financing) calculations were presented that show necessary tariffs for a particular village in order to cover total costs of the system. For the sake of completeness, also calculations, which considered a loan from a bank with an interest rate of 2%, have been made. Table 9 shows the current tariff, the tariff which needs to be applied if the total initial costs are to be covered, the tariff which needs to be applied if total initial costs and the interest rate are to be supplied by the population, and last, but not least, the tariff which needs to be applied when the total operational costs and the interest rate are to be covered.

**Table 9: Comparison of tariffs (per household) considering different scenarios**

| Village | Current Tariff (LE) | Tariff (LE) total cost | Tariff (LE) full cost and interest rate (2%) | Tariff (LE) total operational cost and interest rate (2%) |
|---|---|---|---|---|
| El Moufty El Kobra | 7 | 20[57] | -- | -- |
| Om Sen | 10 | 28 | 34 | 12 |
| Koleaah | 10 | 57 | 70 | 26 |
| Om Shour | 10 | 69 | 84 | 24 |
| Handakokha | 10 | 53 | 65 | 20 |
| Kafr El Gedid | 10 | 63 | 79 | 21 |
| Kouzman | 10 | 55 | 67 | 19 |

Source: Own calculations based on numbers given by RODECO, Implementation Schedule, status September 2010; and Report on Financing Systems, April 2007. See Appendix B.

The following can be observed: In order to cover the total costs, or the total costs and the interest rate, or the total operational costs and the interest rate respectively, the tariff must be adjusted tremendously compared to the current user charge. However, these are the costs which are currently covered by donors, or, on a national scale, by the GoE.

It becomes clear that considering the current high initial costs for the newly established systems, further replication of the GTZ model is threatened, as it cannot no longer be said to be a cheap solution. Furthermore, it becomes obvious that the GoE must reconsider its current tariff system and that it has to take different scenarios into account which are considering both people's affordability to pay and the state's own budget. The adaptation of the GTZ model and the

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[57] Source: Report on Financing Systems, April 2007.

implied tariff system – user carry the O&M costs – can be a first step. In any case, all changes and adjustments must go hand-in-hand with other measurements, out of which the most important is raising awareness.

# 7 Conclusion and recommendation

The study concludes that the introduction of decentralised WWTPs and sewer networks in general is a great opportunity for Egypt, and contributes to the government's aim to cover rural and remote agglomerations with sanitation services. Although it appears that the decentralised approach is facing several constraints and limitations, these difficulties are mostly related to governance mechanisms, however, and thus are time related, especially when bearing in mind that Egypt currently undergoes reform processes, amongst others related to changes in the institutional structures. Secondly, they are related to financial matters. Both matters can be overcome, taking different preconditions into account. An integrated approach is necessary, and there is urgent need to adjust the current tariff system, taking the users' different financial situations into account.

The following is recommended:

It can be observed that Egypt currently is undergoing several reform processes and structural changes. Such processes need time to take hold. Today, development work increasingly demands to be practical in a very short timeframe, meaning that the external development agency should be able to leave the project after a short period of time. This is not possible when dealing with the need of changing people's behaviour and habits. It must be understood that the development, or even, change of certain attitudes and habits needs time, as people need to first understand changes, secondly, to accept the purpose of the requested

change, and thirdly, to adapt to the required change. Eventually, there must be time to adjust and modify.

In this regard, it is recommended that the project team accompanies both water and sewerage companies and communities over a longer time of period. In this way, problems which occur at a later point in time (as the example of the misuse shows) can be taken into consideration and necessary modifications can be undertaken. Currently, the KWSC and the CDAs are unable to make such modifications without external help. Furthermore, it is recommended to further strengthen the relationships with the governmental bodies, and to extend them, meaning not to rely on just one key person.

Regarding the GoE, or its particular institutions, it is recommended to further examine existing tariff systems, since investigations demonstrate clearly that the current tariff system threatens the achievement of the aim of covering Egypt with sanitation services. Several social as well as technical studies should be conducted in this respect. Also, the rising costs of construction need to be investigated, and measurements to prevent construction companies, or others, from taking advantage should be developed.

Furthermore, the government should not concentrate only on the establishment of centralised or so-called cluster systems. Currently, it looks like decentralised systems are recognised but are still neglected. The concerned institutions should study to what extent decentralised services relieve financial and managerial burdens on the government. It seems that governmental representatives are quite aware of the advantages of decentralised sanitation services; nevertheless,

centralised systems appear to attract greater interest. Here, a comparison of centralised versus decentralised systems is recommended as well as creating awareness in this regard. Extensive existing literature can be used for this purpose.

Focusing on more “technical” aspects, it is recommended first, to review existing legislation concerning the power and rights of associations, as well as the practice of penalisation (Law 84/2002, and Law 4/1994). It should be investigated how CDAs can be enabled to have the power to enforce law so as to be able to penalise bad payers or violating acts without calling for external support. The current practice is likely to make communities, especially CDAs, refuse the introduction of a decentralised, self-managed system in their village.

The current situation of misuse of the system calls furthermore not only for review of existing legislation, but also for additional awareness activities in order to make people aware of the practices that are likely to harm the system and threaten its sustainability. Taking into consideration that villagers are likely to apprehend that their behaviour may damage the system, other supplementary solutions must be developed, as well – in a sense, that people have “alternatives” (instead of dumping animal manure into the system).

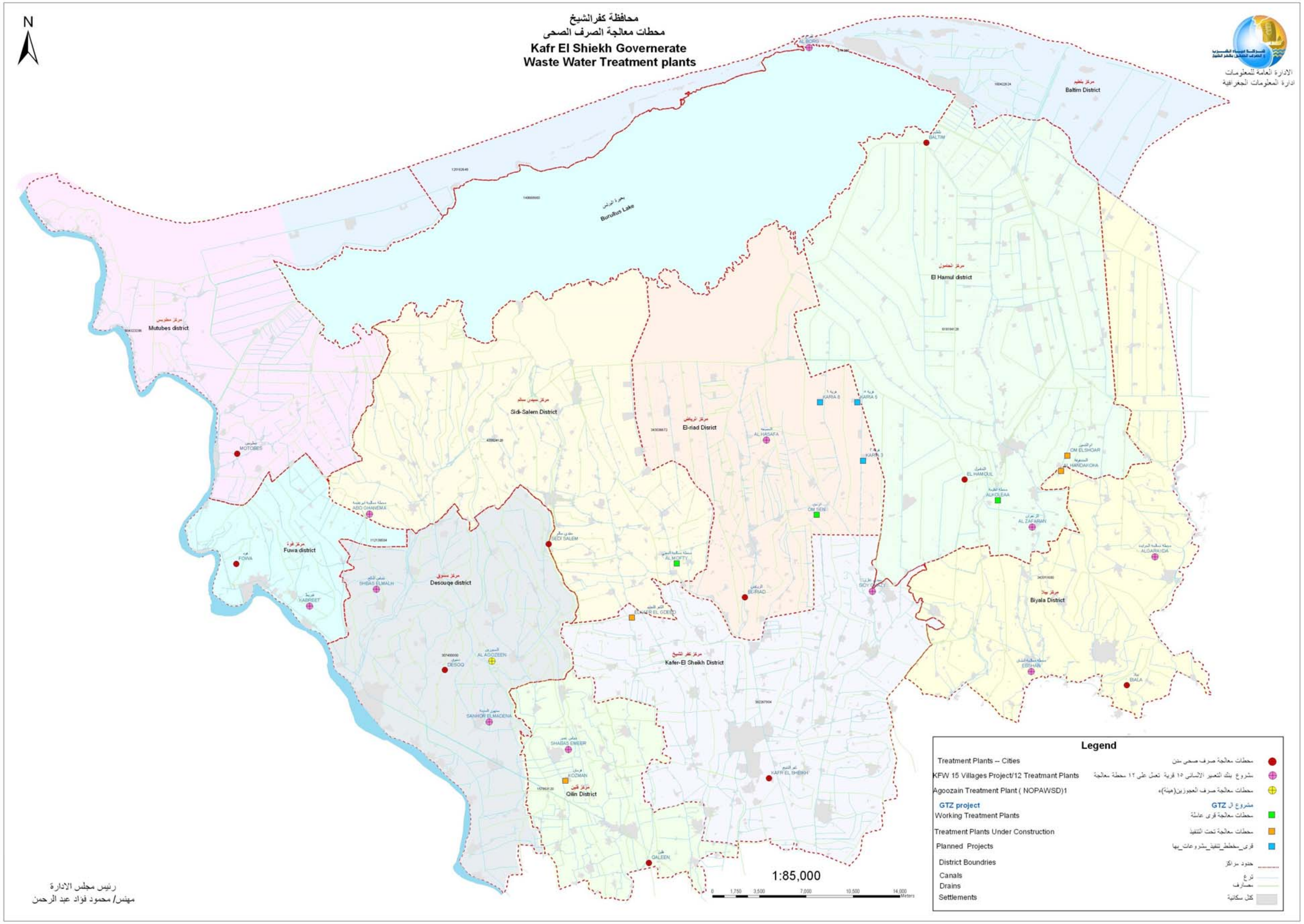
Another rather technical recommendation addresses the present selected treatment system of the GTZ model. Regarding the land requirements, it is recommended to once again reconsider the selected option of waste stabilisation ponds. They require quite a big area, and thus, can limit the establishment of a decentralised WWTP. As mentioned in the theoretical part of this study, there are quite a large

number of decentralised sanitation systems available, which are also applicable with respect to the conditions of developing countries.

Whatever technical solution is selected, the matter of water reuse should be reconsidered as well, as it currently doesn’t play a crucial role in Egypt but could considerably contribute to the country’s water budget. Wehrle, et al. (2007) state that the effluent of the present treatment meets the standards for reuse of treated wastewater given in the Egyptian Law 44/2000. The expansion of reuse of treated wastewater, of course, must go hand-in-hand with further awareness activities that address different levels, and must take different aspects into consideration, such as people’s fear of using reclaimed water, nutrients in reclaimed water, how to irrigate with reclaimed water, etc.

Last, but not least, an exchange with other countries, which also recently introduced decentralised sanitation systems, is recommended. As for Egypt, an exchange of experiences and information with Jordan can be very fruitful, especially considering the issue of reuse of treated wastewater.

**Appendix A: Detailed map of Wastewater treatment plants (GTZ model) in Kafr El Sheikh Governorate**




(Source: RODECO)

# Appendix B: Methodology of Cost Calculations for Villages

For the cost calculations different sources served as references: RODECO, Implementation Schedule, status September 2010; and a Report on Financing Systems, April 2007, prepared by a financial expert; as well as other references. Out of these documents a baseline data for the calculations was developed.

Following baseline data was used:

| | **Operation Baseline Data (Year 2010)** | **Source** |
|---|---|---|
| Year of operation | Particular village | RODECO Implementation Schedule |
| Period of calculation | Design period<br>20 years | Wehrle, et al., 2007 |
| Investment | Particular village | RODECO Implementation Schedule |
| Reinvestment 1<br>Electromechanical works | Period of depreciation:<br>10 years<br>Costs: LE 75,000 | Report on Financing Systems, April 2007 |
| Reinvestment 2<br>Pump station fence | Period of depreciation:<br>15 years<br>Costs: LE 30,000 | Report on Financing Systems, April 2007 |
| Electricity | Cost: LE 2,318.57<br>Escalation: 2% | Report on Financing Systems, April 2007 |
| Staff | Costs: LE 18,000<br>Escalation: 0% | Report on Financing Systems, April 2007 |
| Fuel | Costs: LE 101<br>Escalation: + LE 1 | Report on Financing Systems, April 2007 |
| Administration | Costs: LE 3,440.48<br>Escalation: 1% | Report on Financing Systems, April 2007 |
| Spare parts | Costs: LE 3,310.68<br>Escalation: 1% | Report on Financing Systems, April 2007 |
| Number of household | Particular village | RODECO Implementation Schedule |
| Population growth | Escalation: 2% | Egypt Human Development Report 2010 |
| Interest rate | 2% | Internal documents, other |

# Appendix C: Cost calculations

## OM SEN, necessary tariff to achieve cost recovery full costs

| **Om Sen cost recovery full cost** | **Year** | **2009** | **2010** | **2011** | … | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 500 | 510 | 520 | … | 598 | 609 | 622 | 634 | 647 | 660 | 673 | 686 | 700 | 714 | 728 | 743 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,318.57 | 2,364.94 | | 2,716.57 | 2,770.91 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 101 | 102 | | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| Administration | 1.00% | | 3,440.48 | 3,474.89 | | 3,725.55 | 3,762.80 | 3,800.43 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.74 | 3,994.29 | 4,034.24 | 4,074.58 | 4,115.32 | 4,156.48 |
| Spareparts | 1.00% | | 3,310.68 | 3,343.79 | | 3,584.99 | 3,620.84 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.86 | 3,805.54 | 3,843.60 | 3,882.03 | 3,920.85 | 3,960.06 | 3,999.66 |
| Total Operation | | | 27,170.63 | 27,285.52 | | 28,136.02 | 28,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 28,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 29,653.76 |
| Investments | | 3,300,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 3,300,000.00 | 27,170.63 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Cost per year incl investment costs | | | 192,170.63 | 192,285.52 | | 193,136.02 | 268,264.46 | 193,394.71 | 193,526.81 | 193,660.79 | 193,796.68 | 223,934.50 | 194,074.29 | 194,216.07 | 194,359.90 | 194,505.78 | 269,653.76 |
| Cost per household per year | | | 376.81 | 369.64 | | 323.22 | 440.14 | 311.08 | 305.19 | 299.41 | 293.75 | 332.77 | 282.75 | 277.40 | 272.17 | 267.03 | 362.94 |
| Average cost per household per year | 329.46 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 31.40 | 30.80 | | 26.93 | 36.68 | 25.92 | 25.43 | 24.95 | 24.48 | 27.73 | 23.56 | 23.12 | 22.68 | 22.25 | 30.24 |
| **Average cost per household per month** | **27.46** | | | | | | | | | | | | | | | | |

## OM SEN, necessary tariff to achieve cost recovery total operational costs

| **Om Sen, cost recovery total operational costs** | **Year** | **2009** | **2010** | **2011** | … | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 500 | 510 | 520 | … | 598 | 609 | 622 | 634 | 647 | 660 | 673 | 686 | 700 | 714 | 728 | 743 |
| Costs of Operation per year (incl. re-investments) | | | 27,170.63 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Costs of Operation per household per year | | | 53.28 | 52.45 | | 47.09 | 169.43 | 45.67 | 44.99 | 44.31 | 43.65 | 87.58 | 42.36 | 41.73 | 41.11 | 40.51 | 140.86 |
| Average costs of Operation per household per year | 59.66 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 4.44 | 4.37 | | 3.92 | 14.12 | 3.81 | 3.75 | 3.69 | 3.64 | 7.30 | 3.53 | 3.48 | 3.43 | 3.38 | 11.74 |
| **Average costs of total Operation per household per month** | **4.97** | | | | | | | | | | | | | | | | |

# OM SEN, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| Om Sen, cost recovery full cost incl. interest rate (2%) | Year | 2009 | 2010 | 2011 | ... | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 500 | 510 | 520 | ... | 598 | 609 | 622 | 634 | 647 | 660 | 673 | 686 | 700 | 714 | 728 | 743 |
| Total Operation | | | 27,170.63 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,170.63 | 27,285.52 | | 28,136.02 | 178,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 88,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 179,653.76 |
| Funding requirement | | 3,300,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 3,300,000.00 | 3,135,000.00 | 2,970,000.00 | | 1,815,000.00 | 1,650,000.00 | 1,485,000.00 | 1,320,000.00 | 1,155,000.00 | 990,000.00 | 825,000.00 | 660,000.00 | 495,000.00 | 330,000.00 | 165,000.00 | 0.00 |
| Cost of interest | 2% | | 66,000.00 | 62,700.00 | | 39,600.00 | 36,300.00 | 33,000.00 | 29,700.00 | 26,400.00 | 23,100.00 | 19,800.00 | 16,500.00 | 13,200.00 | 9,900.00 | 6,600.00 | 3,300.00 |
| Bank Installment | 165,000.00 | | 165,000.00 | 165,000.00 | | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 | 165,000.00 |
| Total cost | | | 258,170.63 | 254,985.52 | | 232,736.02 | 379,564.46 | 226,394.71 | 223,226.81 | 220,060.79 | 216,896.68 | 273,734.50 | 210,574.29 | 207,416.07 | 204,259.90 | 201,105.78 | 347,953.76 |
| Costs per household per year | | | 506.22 | 490.17 | | 389.49 | 622.75 | 364.16 | 352.03 | 340.23 | 328.76 | 406.78 | 306.78 | 296.26 | 286.03 | 276.09 | 468.33 |
| Cost per household per month | | | 42.18 | 40.85 | | 32.46 | 51.90 | 30.35 | 29.34 | 28.35 | 27.40 | 33.90 | 25.57 | 24.69 | 23.84 | 23.01 | 39.03 |
| **Average cost per household per month** | **33.59** | | | | | | | | | | | | | | | | |

# OM SEN, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| Om Sen, cost recovery total operational cost and interest rate (2%) | Year | 2009 | 2010 | 2011 | ... | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 500 | 510 | 520 | ... | 598 | 609 | 622 | 634 | 647 | 660 | 673 | 686 | 700 | 714 | 728 | 743 |
| Total Operation | | | 27,170.63 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,170.63 | 27,285.52 | | 28,136.02 | 178,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 88,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 179,653.76 |
| Cost of interest | 2% | | 66,000.00 | 62,700.00 | | 39,600.00 | 36,300.00 | 33,000.00 | 29,700.00 | 26,400.00 | 23,100.00 | 19,800.00 | 16,500.00 | 13,200.00 | 9,900.00 | 6,600.00 | 3,300.00 |
| Total Costs | | | 93,170.63 | 89,985.52 | | 67,736.02 | 214,564.46 | 61,394.71 | 58,226.81 | 55,060.79 | 51,896.68 | 108,734.50 | 45,574.29 | 42,416.07 | 39,259.90 | 36,105.78 | 182,953.76 |
| Costs per household per year | | | 182.69 | 172.98 | | 113.36 | 352.04 | 98.75 | 91.82 | 85.13 | 78.66 | 161.58 | 66.40 | 60.58 | 54.98 | 49.57 | 246.25 |
| Costs per household per month | | | 15.22 | 14.42 | | 9.45 | 29.34 | 8.23 | 7.65 | 7.09 | 6.56 | 13.47 | 5.53 | 5.05 | 4.58 | 4.13 | 20.52 |
| **Average cost per household per month** | **11.11** | | | | | | | | | | | | | | | | |

# KOLEAAH, necessary tariff to achieve cost recovery full costs

| Koleaah, cost recovery full cost | Year | 2009 | 2010 | 2011 | … | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 200 | 204 | 208 | … | 239 | 244 | 249 | 254 | 259 | 264 | 269 | 275 | 280 | 286 | 291 | 297 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,318.57 | 2,364.94 | | 2,716.57 | 2,770.91 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 101 | 102 | | 109 | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| Administration | 1.00% | | 3,440.48 | 3,474.89 | | 3,725.55 | 3,762.80 | 3,800.43 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.74 | 3,994.29 | 4,034.24 | 4,074.58 | 4,115.32 | 4,156.48 |
| Spareparts | 1.00% | | 3,310.68 | 3,343.79 | | 3,584.99 | 3,620.84 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.86 | 3,805.54 | 3,843.60 | 3,882.03 | 3,920.85 | 3,960.06 | 3,999.66 |
| Total Operation | | | 27,170.73 | 27,285.52 | | 28,136.02 | 28,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 28,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 29,653.76 |
| Investments | | 2,600,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 2,600,000.00 | 27,170.73 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Cost per year incl investment costs | | | 157,170.73 | 157,285.52 | | 158,136.02 | 233,264.46 | 158,394.71 | 158,526.81 | 158,660.79 | 158,796.68 | 188,934.50 | 159,074.29 | 159,216.07 | 159,359.90 | 159,505.78 | 234,653.76 |
| Cost per household per year | | | 770.44 | 755.89 | | 661.61 | 956.79 | 636.96 | 624.99 | 613.25 | 601.74 | 701.91 | 579.38 | 568.53 | 557.89 | 547.45 | 789.58 |
| Average cost per household per year | 680.58 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 64.20 | 62.99 | | 55.13 | 79.73 | 53.08 | 52.08 | 51.10 | 50.15 | 58.49 | 48.28 | 47.38 | 46.49 | 45.62 | 65.80 |
| **Average cost per household per month** | **56.71** | | | | | | | | | | | | | | | | |

# KOLEAAH, necessary tariff to achieve cost recovery total operational costs

| Koleaah, cost recovery total operational costs | Year | 2009 | 2010 | 2011 | … | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 200 | 204 | 208 | … | 239 | 244 | 249 | 254 | 259 | 264 | 269 | 275 | 280 | 286 | 291 | 297 |
| Costs of Operation per year | | | 27,170.73 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Costs of Operation per household per year | | | 133.19 | 131.13 | | 117.71 | 423.56 | 114.18 | 112.47 | 110.78 | 109.12 | 218.95 | 105.90 | 104.33 | 102.78 | 101.27 | 352.14 |
| Average costs of Operation per household per year | 149.15 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 11.10 | 10.93 | | 9.81 | 35.30 | 9.52 | 9.37 | 9.23 | 9.09 | 18.25 | 8.82 | 8.69 | 8.57 | 8.44 | 29.35 |
| **Average costs of total Operation per household per month** | **12.43** | | | | | | | | | | | | | | | | |

# KOLEAAH, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| **Koleaah, cost recovery full cost incl. interest rate (2%)** | **Year** | **2009** | **2010** | **2011** | **...** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 200 | 204 | 208 | ... | 239 | 244 | 249 | 254 | 259 | 264 | 269 | 275 | 280 | 286 | 291 | 297 |
| Total Operation | | | 27,170.73 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,170.73 | 27,285.52 | | 28,136.02 | 178,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 88,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 179,653.76 |
| Funding requirement | | 2,600,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 2,600,000.00 | 2,470,000.00 | 2,340,000.00 | | 1,430,000.00 | 1,300,000.00 | 1,170,000.00 | 1,040,000.00 | 910,000.00 | 780,000.00 | 650,000.00 | 520,000.00 | 390,000.00 | 260,000.00 | 130,000.00 | 0.00 |
| Cost of interest | 2% | | 52,000.00 | 49,400.00 | | 31,200.00 | 28,600.00 | 26,000.00 | 23,400.00 | 20,800.00 | 18,200.00 | 15,600.00 | 13,000.00 | 10,400.00 | 7,800.00 | 5,200.00 | 2,600.00 |
| Bank Installment | 130,000.00 | | 130,000.00 | 130,000.00 | | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 | 130,000.00 |
| Total cost | | | 209,170.73 | 206,685.52 | | 189,336.02 | 336,864.46 | 184,394.71 | 181,926.81 | 179,460.79 | 176,996.68 | 234,534.50 | 172,074.29 | 169,616.07 | 167,159.90 | 164,705.78 | 312,253.76 |
| Costs per household per year | | | 1,025.35 | 993.30 | | 792.14 | 1,381.73 | 741.51 | 717.24 | 693.65 | 670.71 | 871.31 | 626.73 | 605.67 | 585.19 | 565.30 | 1,050.69 |
| Cost per household per month | | | 85.45 | 82.77 | | 66.01 | 115.14 | 61.79 | 59.77 | 57.80 | 55.89 | 72.61 | 52.23 | 50.47 | 48.77 | 47.11 | 87.56 |
| **Average cost per household per month** | **69.39** | | | | | | | | | | | | | | | | |

# KOLEAAH, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| **Koleaah, cost recovery total operational cost and interest rate (2%)** | **Year** | **2009** | **2010** | **2011** | **...** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 200 | 204 | 208 | ... | 239 | 244 | 249 | 254 | 259 | 264 | 269 | 275 | 280 | 286 | 291 | 297 |
| Total Operation | | | 27,170.73 | 27,285.52 | | 28,136.02 | 103,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 58,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 104,653.76 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,170.73 | 27,285.52 | | 28,136.02 | 178,264.46 | 28,394.71 | 28,526.81 | 28,660.79 | 28,796.68 | 88,934.50 | 29,074.29 | 29,216.07 | 29,359.90 | 29,505.78 | 179,653.76 |
| Cost of interest | 2% | | 52,000.00 | 49,400.00 | | 31,200.00 | 28,600.00 | 26,000.00 | 23,400.00 | 20,800.00 | 18,200.00 | 15,600.00 | 13,000.00 | 10,400.00 | 7,800.00 | 5,200.00 | 2,600.00 |
| Total Costs | | | 79,170.73 | 76,685.52 | | 59,336.02 | 206,864.46 | 54,394.71 | 51,926.81 | 49,460.79 | 46,996.68 | 104,534.50 | 42,074.29 | 39,616.07 | 37,159.90 | 34,705.78 | 182,253.76 |
| Costs per household per year | | | 388.09 | 368.54 | | 248.25 | 848.50 | 218.74 | 204.72 | 191.17 | 178.09 | 388.35 | 153.24 | 141.46 | 130.09 | 119.12 | 613.26 |
| Costs per household per month | | | 32.34 | 30.71 | | 20.69 | 70.71 | 18.23 | 17.06 | 15.93 | 14.84 | 32.36 | 12.77 | 11.79 | 10.84 | 9.93 | 51.10 |
| **Average cost per household per month** | **25.11** | | | | | | | | | | | | | | | | |

# OM SHOUR, necessary tariff to achieve cost recovery full costs

| **Om Shour, cost recovery full cost** | **Year** | **2010** | **2011** | **2012** | … | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | … | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,364.94 | 2,412.24 | | 2,770.90 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 | 3,445.27 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 102 | 103 | | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Administration | 1.00% | | 3,474.89 | 3,509.64 | | 3,762.81 | 3,800.44 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.75 | 3,994.30 | 4,034.24 | 4,074.58 | 4,115.33 | 4,156.48 | 4,198.05 |
| Spareparts | 1.00% | | 3,343.79 | 3,377.23 | | 3,620.85 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.87 | 3,805.54 | 3,843.60 | 3,882.04 | 3,920.86 | 3,960.07 | 3,999.67 | 4,039.66 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 28,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 29,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 29,803.98 |
| Investments | | 5,300,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 5,300,000.00 | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Cost per year incl investment costs | | | 292,285.62 | 292,402.11 | | 293,264.56 | 368,394.81 | 293,526.91 | 293,660.89 | 293,796.78 | 293,934.60 | 324,074.38 | 294,216.17 | 294,359.99 | 294,505.88 | 294,653.86 | 369,803.98 |
| Cost per household per year | | | 955.18 | 936.83 | | 817.97 | 1,007.37 | 786.91 | 771.83 | 757.05 | 742.55 | 802.64 | 714.40 | 700.74 | 687.34 | 674.20 | 829.56 |
| Average cost per household per year | 821.98 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 79.60 | 78.07 | | 68.16 | 83.95 | 65.58 | 64.32 | 63.09 | 61.88 | 66.89 | 59.53 | 58.39 | 57.28 | 56.18 | 69.13 |
| **Average cost per household per month** | **68.50** | | | | | | | | | | | | | | | | |

# OM SHOUR, necessary tariff to achieve cost recovery total operational costs

| **Om Shour, cost recovery total operational costs** | **Year** | **2010** | **2011** | **2012** | … | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | … | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Costs of Operation per year | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Costs of Operation per household per year | | | 89.17 | 87.79 | | 78.84 | 282.73 | 76.48 | 75.33 | 74.20 | 73.10 | 146.31 | 70.94 | 69.89 | 68.86 | 67.85 | 235.10 |
| Average costs of Operation per household per year | 99.79 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 7.43 | 7.32 | | 6.57 | 23.56 | 6.37 | 6.28 | 6.18 | 6.09 | 12.19 | 5.91 | 5.82 | 5.74 | 5.65 | 19.59 |
| **Average costs of Operation per household per month** | **8.32** | | | | | | | | | | | | | | | | |

# OM SHOUR, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| **Om Shour, cost recovery full cost incl. interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | ... | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Funding requirement | | 5,300,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 5,300,000.00 | 5,035,000.00 | 4,770,000.00 | | 2,915,000.00 | 2,650,000.00 | 2,385,000.00 | 2,120,000.00 | 1,855,000.00 | 1,590,000.00 | 1,325,000.00 | 1,060,000.00 | 795,000.00 | 530,000.00 | 265,000.00 | 0.00 |
| Cost of interest | 2% | | 106,000.00 | 100,700.00 | | 63,600.00 | 58,300.00 | 53,000.00 | 47,700.00 | 42,400.00 | 37,100.00 | 31,800.00 | 26,500.00 | 21,200.00 | 15,900.00 | 10,600.00 | 5,300.00 |
| Bank Installment | 265,000.00 | | 265,000.00 | 265,000.00 | | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 | 265,000.00 |
| Total cost | | | 398,285.62 | 393,102.11 | | 356,864.56 | 501,694.81 | 346,526.91 | 341,360.89 | 336,196.78 | 331,034.60 | 385,874.38 | 320,716.17 | 315,559.99 | 310,405.88 | 305,253.86 | 450,103.98 |
| Costs per household per year | | | 1,301.59 | 1,259.46 | | 995.36 | 1,371.88 | 929.00 | 897.20 | 866.30 | 836.28 | 955.70 | 778.75 | 751.20 | 724.45 | 698.45 | 1,009.69 |
| Cost per household per month | | | 108.47 | 104.95 | | 82.95 | 114.32 | 77.42 | 74.77 | 72.19 | 69.69 | 79.64 | 64.90 | 62.60 | 60.37 | 58.20 | 84.14 |
| **Average cost per household per month** | **83.79** | | | | | | | | | | | | | | | | |

# OM SHOUR, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| **Om Shour, cost recovery total operational cost and interest (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | ... | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Cost of interest | 2% | | 106,000.00 | 100,700.00 | | 63,600.00 | 58,300.00 | 53,000.00 | 47,700.00 | 42,400.00 | 37,100.00 | 31,800.00 | 26,500.00 | 21,200.00 | 15,900.00 | 10,600.00 | 5,300.00 |
| Total Costs | | | 133,285.62 | 128,102.11 | | 91,864.56 | 236,694.81 | 81,526.91 | 76,360.89 | 71,196.78 | 66,034.60 | 120,874.38 | 55,716.17 | 50,559.99 | 45,405.88 | 40,253.86 | 185,103.98 |
| Costs per household per year | | | 435.57 | 410.43 | | 256.23 | 647.24 | 218.56 | 200.70 | 183.46 | 166.82 | 299.37 | 135.29 | 120.36 | 105.97 | 92.10 | 415.23 |
| Costs per household per month | | | 36.30 | 34.20 | | 21.35 | 53.94 | 18.21 | 16.73 | 15.29 | 13.90 | 24.95 | 11.27 | 10.03 | 8.83 | 7.68 | 34.60 |
| **Average cost per household per month** | **23.61** | | | | | | | | | | | | | | | | |

# HANDAKOKHA, necessary tariff to achieve cost recovery full costs

| **Handakokha, cost recovery full cost** | **Year** | **2010** | **2011** | **2012** | **…** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | … | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,364.94 | 2,412.24 | | 2,770.90 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 | 3,445.27 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 102 | 103 | | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Administration | 1.00% | | 3,474.89 | 3,509.64 | | 3,762.81 | 3,800.44 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.75 | 3,994.30 | 4,034.24 | 4,074.58 | 4,115.33 | 4,156.48 | 4,198.05 |
| Spareparts | 1.00% | | 3,343.79 | 3,377.23 | | 3,620.85 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.87 | 3,805.54 | 3,843.60 | 3,882.04 | 3,920.86 | 3,960.07 | 3,999.67 | 4,039.66 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 28,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 29,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 29,803.98 |
| Investments | | 3,900,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 3,900,000.00 | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Cost per year incl investment costs | | | 222,285.62 | 222,402.11 | | 223,264.56 | 298,394.81 | 223,526.91 | 223,660.89 | 223,796.78 | 223,934.60 | 254,074.38 | 224,216.17 | 224,359.99 | 224,505.88 | 224,653.86 | 299,803.98 |
| Cost per household per year | | | 726.42 | 712.55 | | 622.73 | 815.96 | 599.25 | 587.85 | 576.67 | 565.71 | 629.27 | 544.43 | 534.10 | 523.97 | 514.03 | 672.53 |
| Average cost per household per year | 631.21 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 60.54 | 59.38 | | 51.89 | 68.00 | 49.94 | 48.99 | 48.06 | 47.14 | 52.44 | 45.37 | 44.51 | 43.66 | 42.84 | 56.04 |
| **Average cost per household per month** | **52.60** | | | | | | | | | | | | | | | | |

# HANDAKOKHA, necessary tariff to achieve cost recovery total operational costs

| **Handakokha, cost recovery total operational costs** | **Year** | **2010** | **2011** | **2012** | **…** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | … | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Costs of Operation per year | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Costs of Operation per household per year | | | 89.17 | 87.79 | | 78.84 | 282.73 | 76.48 | 75.33 | 74.20 | 73.10 | 146.31 | 70.94 | 69.89 | 68.86 | 67.85 | 235.10 |
| Average costs of Operation per household per year | 99.79 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 7.43 | 7.32 | | 6.57 | 23.56 | 6.37 | 6.28 | 6.18 | 6.09 | 12.19 | 5.91 | 5.82 | 5.74 | 5.65 | 19.59 |
| **Average costs of Operation per household per month** | **8.32** | | | | | | | | | | | | | | | | |

# HANDAKOKHA, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| **Handakokha, cost recovery full cost incl. interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | ... | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Funding requirement | | 3,900,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 3,900,000.00 | 3,705,000.00 | 3,510,000.00 | | 2,145,000.00 | 1,950,000.00 | 1,755,000.00 | 1,560,000.00 | 1,365,000.00 | 1,170,000.00 | 975,000.00 | 780,000.00 | 585,000.00 | 390,000.00 | 195,000.00 | 0.00 |
| Cost of interest | 2% | | 78,000.00 | 74,100.00 | | 46,800.00 | 42,900.00 | 39,000.00 | 35,100.00 | 31,200.00 | 27,300.00 | 23,400.00 | 19,500.00 | 15,600.00 | 11,700.00 | 7,800.00 | 3,900.00 |
| Bank Installment | 195,000.00 | | 195,000.00 | 195,000.00 | | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 | 195,000.00 |
| Total cost | | | 300,285.62 | 296,502.11 | | 270,064.56 | 416,294.81 | 262,526.91 | 258,760.89 | 254,996.78 | 251,234.60 | 307,474.38 | 243,716.17 | 239,959.99 | 236,205.88 | 232,453.86 | 378,703.98 |
| Costs per household per year | | | 981.33 | 949.96 | | 753.26 | 1,138.36 | 703.80 | 680.10 | 657.07 | 634.68 | 761.53 | 591.78 | 571.23 | 551.27 | 531.88 | 849.52 |
| Cost per household per month | | | 81.78 | 79.16 | | 62.77 | 94.86 | 58.65 | 56.68 | 54.76 | 52.89 | 63.46 | 49.32 | 47.60 | 45.94 | 44.32 | 70.79 |
| **Average cost per household per month** | **64.35** | | | | | | | | | | | | | | | | |

# HANDAKOKHA, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| **Handakokha, cost recovery total oprtl. cost and interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 300 | 306 | 312 | ... | 359 | 366 | 373 | 380 | 388 | 396 | 404 | 412 | 420 | 428 | 437 | 446 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Cost of interest | 2% | | 78,000.00 | 74,100.00 | | 46,800.00 | 42,900.00 | 39,000.00 | 35,100.00 | 31,200.00 | 27,300.00 | 23,400.00 | 19,500.00 | 15,600.00 | 11,700.00 | 7,800.00 | 3,900.00 |
| Total Costs | | | 105,285.62 | 101,502.11 | | 75,064.56 | 221,294.81 | 67,526.91 | 63,760.89 | 59,996.78 | 56,234.60 | 112,474.38 | 48,716.17 | 44,959.99 | 41,205.88 | 37,453.86 | 183,703.98 |
| Costs per household per year | | | 344.07 | 325.20 | | 209.37 | 605.13 | 181.03 | 167.58 | 154.60 | 142.06 | 278.57 | 118.29 | 107.03 | 96.17 | 85.70 | 412.09 |
| Costs per household per month | | | 28.67 | 27.10 | | 17.45 | 50.43 | 15.09 | 13.97 | 12.88 | 11.84 | 23.21 | 9.86 | 8.92 | 8.01 | 7.14 | 34.34 |
| **Average cost per household per month** | **20.06** | | | | | | | | | | | | | | | | |

# KAFR EL GEDID, necessary tariff to achieve cost recovery full costs

| **Kafr El Gedid, cost recovery full cost** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 355 | 362 | 369 | ... | 424 | 433 | 441 | 450 | 459 | 468 | 478 | 487 | 497 | 507 | 517 | 528 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,364.94 | 2,412.24 | | 2,770.90 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 | 3,445.27 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 102 | 103 | | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Administration | 1.00% | | 3,474.89 | 3,509.64 | | 3,762.81 | 3,800.44 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.75 | 3,994.30 | 4,034.24 | 4,074.58 | 4,115.33 | 4,156.48 | 4,198.05 |
| Spareparts | 1.00% | | 3,343.79 | 3,377.23 | | 3,620.85 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.87 | 3,805.54 | 3,843.60 | 3,882.04 | 3,920.86 | 3,960.07 | 3,999.67 | 4,039.66 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 28,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 29,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 29,803.98 |
| Investments | | 5,800,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 5,800,000.00 | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Cost per year incl investment costs | | | 317,285.62 | 317,402.11 | | 318,264.56 | 393,394.81 | 318,526.91 | 318,660.89 | 318,796.78 | 318,934.60 | 349,074.38 | 319,216.17 | 319,359.99 | 319,505.88 | 319,653.86 | 394,803.98 |
| Cost per household per year | | | 876.24 | 859.37 | | 750.17 | 909.07 | 721.63 | 707.78 | 694.20 | 680.88 | 730.61 | 655.02 | 642.46 | 630.16 | 618.09 | 748.43 |
| Average cost per household per year | 752.21 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 73.02 | 71.61 | | 62.51 | 75.76 | 60.14 | 58.98 | 57.85 | 56.74 | 60.88 | 54.58 | 53.54 | 52.51 | 51.51 | 62.37 |
| **Average cost per household per month** | **62.68** | | | | | | | | | | | | | | | | |

# KAFR EL GEDID, necessary tariff to achieve cost recovery total operational costs

| **Kafr El Gedid, cost recovery total operational costs** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 355 | 362 | 369 | ... | 424 | 433 | 441 | 450 | 459 | 468 | 478 | 487 | 497 | 507 | 517 | 528 |
| Costs of Operation per year | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Costs of Operation per household per year | | | 75.35 | 74.19 | | 66.62 | 238.93 | 64.63 | 63.66 | 62.71 | 61.77 | 123.64 | 59.95 | 59.06 | 58.19 | 57.34 | 198.68 |
| Average costs of Operation per household per year | 84.33 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 6.28 | 6.18 | | 5.55 | 19.91 | 5.39 | 5.30 | 5.23 | 5.15 | 10.30 | 5.00 | 4.92 | 4.85 | 4.78 | 16.56 |
| **Average costs of Operation per household per month** | **7.03** | | | | | | | | | | | | | | | | |

# KAFR EL GEDID, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| **Kafr El Gedid, cost recovery full cost incl. interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 355 | 362 | 369 | ... | 424 | 433 | 441 | 450 | 459 | 468 | 478 | 487 | 497 | 507 | 517 | 528 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Funding requirement | | 5,800,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 5,800,000.00 | 5,510,000.00 | 5,220,000.00 | | 3,190,000.00 | 2,900,000.00 | 2,610,000.00 | 2,320,000.00 | 2,030,000.00 | 1,740,000.00 | 1,450,000.00 | 1,160,000.00 | 870,000.00 | 580,000.00 | 290,000.00 | 0.00 |
| Cost of interest | 2% | | 116,000.00 | 110,200.00 | | 69,600.00 | 63,800.00 | 58,000.00 | 52,200.00 | 46,400.00 | 40,600.00 | 34,800.00 | 29,000.00 | 23,200.00 | 17,400.00 | 11,600.00 | 5,800.00 |
| Bank Installment | 290,000.00 | | 290,000.00 | 290,000.00 | | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 | 290,000.00 |
| Total cost | | | 433,285.62 | 427,602.11 | | 387,864.56 | 532,194.81 | 376,526.91 | 370,860.89 | 365,196.78 | 359,534.60 | 413,874.38 | 348,216.17 | 342,559.99 | 336,905.88 | 331,253.86 | 475,603.98 |
| Costs per household per year | | | 1,196.59 | 1,157.74 | | 914.22 | 1,229.82 | 853.03 | 823.72 | 795.24 | 767.56 | 866.24 | 714.53 | 689.14 | 664.47 | 640.52 | 901.60 |
| Cost per household per month | | | 99.72 | 96.48 | | 76.18 | 102.48 | 71.09 | 68.64 | 66.27 | 63.96 | 72.19 | 59.54 | 57.43 | 55.37 | 53.38 | 75.13 |
| **Average cost per household per month** | **76.68** | | | | | | | | | | | | | | | | |

# KAFR EL GEDID, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| **Kafr El Gedid, cost recovery total operational cost and interest (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 355 | 362 | 369 | ... | 424 | 433 | 441 | 450 | 459 | 468 | 478 | 487 | 497 | 507 | 517 | 528 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Cost of interest | 2% | | 116,000.00 | 110,200.00 | | 69,600.00 | 63,800.00 | 58,000.00 | 52,200.00 | 46,400.00 | 40,600.00 | 34,800.00 | 29,000.00 | 23,200.00 | 17,400.00 | 11,600.00 | 5,800.00 |
| Total Costs | | | 143,285.62 | 137,602.11 | | 97,864.56 | 242,194.81 | 86,526.91 | 80,860.89 | 75,196.78 | 69,534.60 | 123,874.38 | 58,216.17 | 52,559.99 | 46,905.88 | 41,253.86 | 185,603.98 |
| Costs per household per year | | | 395.71 | 372.56 | | 230.67 | 559.67 | 196.03 | 179.60 | 163.75 | 148.45 | 259.27 | 119.46 | 105.74 | 92.51 | 79.77 | 351.85 |
| Costs per household per month | | | 32.98 | 31.05 | | 19.22 | 46.64 | 16.34 | 14.97 | 13.65 | 12.37 | 21.61 | 9.95 | 8.81 | 7.71 | 6.65 | 29.32 |
| **Average cost per household per month** | **21.02** | | | | | | | | | | | | | | | | |

# KOUZMAN, necessary tariff to achieve cost recovery full costs

| **Kouzman, cost recovery full cost** | **Year** | **2010** | **2011** | **2012** | **…** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 400 | 408 | 416 | … | 478 | 488 | 497 | 507 | 517 | 528 | 538 | 549 | 560 | 571 | 583 | 594 |
| | **Escalation** | | | | | | | | | | | | | | | | |
| Electricity | 2.00% | | 2,364.94 | 2,412.24 | | 2,770.90 | 2,826.32 | 2,882.85 | 2,940.51 | 2,999.32 | 3,059.30 | 3,120.49 | 3,182.90 | 3,246.56 | 3,311.49 | 3,377.72 | 3,445.27 |
| Staff | 0.00% | | 18,000.00 | 18,000.00 | | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 | 18,000.00 |
| Fuel | LE 1 | | 102 | 103 | | 110 | 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 | 121 |
| Administration | 1.00% | | 3,474.89 | 3,509.64 | | 3,762.81 | 3,800.44 | 3,838.44 | 3,876.82 | 3,915.59 | 3,954.75 | 3,994.30 | 4,034.24 | 4,074.58 | 4,115.33 | 4,156.48 | 4,198.05 |
| Spareparts | 1.00% | | 3,343.79 | 3,377.23 | | 3,620.85 | 3,657.05 | 3,693.62 | 3,730.56 | 3,767.87 | 3,805.54 | 3,843.60 | 3,882.04 | 3,920.86 | 3,960.07 | 3,999.67 | 4,039.66 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 28,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 29,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 29,803.98 |
| Investments | | 5,700,000.00 | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost | | 5,700,000.00 | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Cost per year incl investment costs | | | 312,285.62 | 312,402.11 | | 313,264.56 | 388,394.81 | 313,526.91 | 313,660.89 | 313,796.78 | 313,934.60 | 344,074.38 | 314,216.17 | 314,359.99 | 314,505.88 | 314,653.86 | 389,803.98 |
| Cost per household per year | | | 765.41 | 750.68 | | 655.31 | 796.55 | 630.40 | 618.30 | 606.44 | 594.81 | 639.13 | 572.22 | 561.26 | 550.51 | 539.97 | 655.82 |
| Average cost per household per year | 657.36 | | | | | | | | | | | | | | | | |
| Cost per household per month | | | 63.78 | 62.56 | | 54.61 | 66.38 | 52.53 | 51.52 | 50.54 | 49.57 | 53.26 | 47.69 | 46.77 | 45.88 | 45.00 | 54.65 |
| **Average cost per household per month** | **54.78** | | | | | | | | | | | | | | | | |

# KOUZMAN, necessary tariff to achieve cost recovery total operational costs

| **Kouzman, cost recovery total operational costs** | **Year** | **2010** | **2011** | **2012** | **…** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 400 | 408 | 416 | … | 478 | 488 | 497 | 507 | 517 | 528 | 538 | 549 | 560 | 571 | 583 | 594 |
| Costs of Operation per year | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Costs of Operation per household per year | | | 66.88 | 65.85 | | 59.13 | 212.05 | 57.36 | 56.50 | 55.65 | 54.82 | 109.73 | 53.21 | 52.42 | 51.65 | 50.89 | 176.33 |
| Average costs of Operation per household per year | 74.84 | | | | | | | | | | | | | | | | |
| Cost of Operation per household per month | | | 5.57 | 5.49 | | 4.93 | 17.67 | 4.78 | 4.71 | 4.64 | 4.57 | 9.14 | 4.43 | 4.37 | 4.30 | 4.24 | 14.69 |
| **Average costs of Operation per household per month** | **6.24** | | | | | | | | | | | | | | | | |

# KOUZMAN, necessary tariff to achieve cost recovery full cost incl. interest (2%)

| **Kouzman, cost recovery full cost incl. interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 400 | 408 | 416 | ... | 478 | 488 | 497 | 507 | 517 | 528 | 538 | 549 | 560 | 571 | 583 | 594 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Funding requirement | | 5,700,000.00 | | | | | | | | | | | | | | | |
| Debt Balance | | 5,700,000.00 | 5,415,000.00 | 5,130,000.00 | | 3,135,000.00 | 2,850,000.00 | 2,565,000.00 | 2,280,000.00 | 1,995,000.00 | 1,710,000.00 | 1,425,000.00 | 1,140,000.00 | 855,000.00 | 570,000.00 | 285,000.00 | 0.00 |
| Cost of interest | 2% | | 114,000.00 | 108,300.00 | | 68,400.00 | 62,700.00 | 57,000.00 | 51,300.00 | 45,600.00 | 39,900.00 | 34,200.00 | 28,500.00 | 22,800.00 | 17,100.00 | 11,400.00 | 5,700.00 |
| Bank Installment | 285,000.00 | | 285,000.00 | 285,000.00 | | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 | 285,000.00 |
| Total cost | | | 426,285.62 | 420,702.11 | | 381,664.56 | 526,094.81 | 370,526.91 | 364,960.89 | 359,396.78 | 353,834.60 | 408,274.38 | 342,716.17 | 337,159.99 | 331,605.88 | 326,053.86 | 470,503.98 |
| Costs per household per year | | | 1,044.82 | 1,010.91 | | 798.40 | 1,078.95 | 745.00 | 719.42 | 694.56 | 670.41 | 758.38 | 624.13 | 601.97 | 580.44 | 559.53 | 791.59 |
| Cost per household per month | | | 87.07 | 84.24 | | 66.53 | 89.91 | 62.08 | 59.95 | 57.88 | 55.87 | 63.20 | 52.01 | 50.16 | 48.37 | 46.63 | 65.97 |
| **Average cost per household per month** | **67.01** | | | | | | | | | | | | | | | | |

# KOUZMAN, necessary tariff to achieve cost recovery total operational cost and interest (2%)

| **Kouzman, cost recovery total operational cost and interest rate (2%)** | **Year** | **2010** | **2011** | **2012** | **...** | **2019** | **2020** | **2021** | **2022** | **2023** | **2024** | **2025** | **2026** | **2027** | **2028** | **2029** | **2030** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Households | 2,00% | 400 | 408 | 416 | ... | 478 | 488 | 497 | 507 | 517 | 528 | 538 | 549 | 560 | 571 | 583 | 594 |
| Total Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 103,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 59,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 104,803.98 |
| Investments | | | | | | | 75,000.00 | | | | | 30,000.00 | | | | | 75,000.00 |
| Total Cost of Operation | | | 27,285.62 | 27,402.11 | | 28,264.56 | 178,394.81 | 28,526.91 | 28,660.89 | 28,796.78 | 28,934.60 | 89,074.38 | 29,216.17 | 29,359.99 | 29,505.88 | 29,653.86 | 179,803.98 |
| Cost of interest | 2% | | 114,000.00 | 108,300.00 | | 68,400.00 | 62,700.00 | 57,000.00 | 51,300.00 | 45,600.00 | 39,900.00 | 34,200.00 | 28,500.00 | 22,800.00 | 17,100.00 | 11,400.00 | 5,700.00 |
| Total Costs | | | 141,285.62 | 135,702.11 | | 96,664.56 | 241,094.81 | 85,526.91 | 79,960.89 | 74,396.78 | 68,834.60 | 123,274.38 | 57,716.17 | 52,159.99 | 46,605.88 | 41,053.86 | 185,503.98 |
| Costs per household per year | | | 346.29 | 326.08 | | 202.21 | 494.45 | 171.97 | 157.62 | 143.78 | 130.42 | 228.99 | 105.11 | 93.13 | 81.58 | 70.45 | 312.10 |
| Costs per household per month | | | 28.86 | 27.17 | | 16.85 | 41.20 | 14.33 | 13.14 | 11.98 | 10.87 | 19.08 | 8.76 | 7.76 | 6.80 | 5.87 | 26.01 |
| **Average cost per household per month** | **18.47** | | | | | | | | | | | | | | | | |

## Appendix D: Interview Villagers

1. If you had to describe the project in just a few sentences, what would you tell?

2. Did you get enough information?

3. Do you think such decentralised sanitation systems (GTZ) should be introduced into other villages as well?

   → Why / why not?

4. Did the establishment of the system improve villagers' quality of life?

5. If yes, how did it improve your quality of life?

6. Do you need more information regarding the system, how it is working, how to use the system in order not to harm it, its impacts, etc.?

7. Do you feel responsible for the system, e.g. do you feel it belongs to the village and hence you have to take care?

8. Right now every household pays a monthly fee of about 7 LE / (Moufty) / LE 10 (others). With this amount the costs of O&M and rehabilitation costs are covered. The initial investment costs (construction of sewage collection system including interceptor tanks and/or manholes, pumping stations as far as required and the treatment plant including the various basins) are carried by donors, like GTZ, Egyptian government or the World Bank.

   a. Let's assume such donor is not more available, and the village community had to cover total costs, meaning investment costs and costs for O&M. Would you generally be willing and able to pay a higher tariff in order to cover all costs?

   b. Calculations show that in order to cover total costs, the user charge must be LE 60 (Koleeah) / LE 20 (Moufty) per month. Would you be willing and able to pay this amount in order to have the WWTP?

   c. What do you think would be the maximum amount you would be willing and able to pay per month

   □ 15-20LE □ 21-30LE □ 31-40LE □ 41-50LE

   □ 51-60LE □ 61-70LE □ more

**For Woman**

9. Due to the installation of the sanitation system a lot of things changed in the village. For example, you don’t have to go to the river anymore and do your washings there.

    a. Do you think this is an improvement?

    b. Are there also disadvantages? Which?

## Appendix E: Interview Community Development Associations

1. What is your working position?
2. Since when you are working with the project / are you related to the project
3. If you had to describe the project in just a few sentences, what would you tell?
4. Do you as CDA feel involved adequately into the project (its formulation, performance, information, discussions, etc)
    a. In the past
    b. Now
5. Did you get enough information from the project team (GTZ, RODECO)?
6. What is the main role of KWSC (catchwords)
7. What is the main role of CDA (catchwords)
8. Regarding the roles and responsibilities of CDA/Community compared to the ones of KWSC – are they clearly defined?
9. KWSC's role is to supervise the construction of the WWTP, and to support you (technical issues) when you request help.

   So far, is there a good co-operation with KWSC, do they offer good service?
10. Is there something that needs to be improved regarding their service? (What)
11. Is there trust between CDA/Villagers and KWSC? For example when a problem occurs do you contact KWSC and tell them about?
12. Do you think such decentralised sanitation systems (GTZ) should be introduced into other villages as well?

    → Why / why not
13. Did the establishment of the system improve villagers' quality of life?
14. If yes, how do you think it improved your quality of life?
15. Do you need more information regarding the system, how it is working, how to use the system in order not to harm it, its impacts, etc.?

16. Do you feel responsible for the system, e.g. do you feel it belongs to the village and hence you have to take care?

    □ Yes □ No

17. Right now every household pays a monthly fee of LE 10 (Koleeah) / LE 7 (Moufty). With this amount the costs of O&M and partly future investments are covered. The initial investment costs (construction of sewage collection system including interceptor tanks and/or manholes, pumping stations as far as required and the treatment plant including the various basins) are carried by donors, like GTZ, the Egyptian government or the World Bank.

    a. Let's assume such donor is not more available, and the village community had to cover all costs meaning initial costs and costs for O&M and future investments. Would you generally be willing and able to pay a higher tariff in order to cover all costs?

    b. Calculations show that in order to do so, the user charge must be about LE 60 per month (Koleeah) / LE 20 per month (Moufty). Would you be willing and able to pay this amount in order to have the WWTP?

    c. What do you think would be the maximum amount you would be willing and able to pay per month

    □ 15-20LE □ 21-30LE □ 31-40LE □ 41-50LE

    □ 51-60LE □ 61-70LE □ more

# Appendix F: Interview Kafr El Sheikh Water and Sewerage Company

1. What is your working position?

2. Since when you are working with the project / are you related to the project

**Decentralised Sanitation Systems in general**

The following questions will mainly concentrate on decentralised WWTP, whereby the definition of "decentralised" here is as follows:

The collection, treatment and reuse or disposal of wastewater at or near its point of generation.

3. Wastewater can be treated in central and decentralised systems. Right now there is the plan to have cluster systems combined with decentralised systems. Let's assume a village without central plant and sewerage system in place.

    a. Do you think decentralised WWTP are a good idea (likes / dislikes)?

    b. Where do you see constraints of implementing decentralised systems in general?

    c. Assuming same overall unit cost for centralised (cluster systems) and decentralised WWTP, under which conditions would you go for a decentralised solution?

    d. Would there be reasons **not** to go for decentralised solutions if overall costs were lower than for centralised solutions? If so, what are they?

**The project of GTZ**

4. Referring to your experience with the GTZ model, if you had to describe the project in just a few sentences, what would you tell?

5. Do you think such decentralised WWTP (GTZ) should be introduced into other villages as well?

    → Why / why not

6. Do you get enough information from the project team (GTZ/RODECO)?

7. Do you get enough information from the CDA / Villagers about what is going on?
8. Is there trust between CDA/Villagers and KWSC, meaning do you feel that the CDA contacts and informs you in case of occurrence of problems?
9. What is the main role of KWSC (catchwords)
10. What is the main role of CDA (catchwords)
11. Regarding the roles and responsibilities of CDA/Community compared to the ones of KWSC – are they clearly defined?
12. As a matter of fact, replication of the GTZ model in other villages happened to be slower than expected. In your opinion, why do you think the GTZ model was not replicated more often?
13. Do you think the establishment of the system did improve villagers' quality of life?
14. If yes, how do you think it improved their quality of life?

## Appendix G: Interview Governmental Representatives

1. What is your working position?

The following questions will mainly concentrate on decentralised WWTP, whereby the definition of “decentralised” here is as follows:

The collection, treatment and reuse or disposal of wastewater at or near its point of generation.

2. Wastewater can be treated in central and decentralised systems. Decentralised systems as the GTZ model approach small villages with not more than 5000 residents. Let’s assume a village without central plant and sewerage system in place.

    a. Do you think decentralised WWTP are a good idea (likes / dislikes)?

    b. Assuming same overall unit cost for centralised (cluster systems) and decentralised WWTP, under which conditions would you go for a decentralised solution?

    c. Would there be reasons **not** to go for decentralised solutions if overall costs were lower than for centralised solutions? If so, what are they?

3. Where do you see constraints of implementing decentralised systems?

4. Regarding the GTZ model, villagers via a monthly fee are carrying costs of O&M and future investments (total costs). Initial costs, however, are to be carried by a donor or the GoE. The finance of the initial costs is one of the major constraints not only for decentralised but also for central systems. Regarding data given by CAPMAS in 2006 the coverage rate of water sanitation was 50% for whole Egypt, and only about 24% for rural Egypt.

    a. Do you have estimate about how much money must be spent in order to cover rural Egypt with sanitation facilities?

    b. Do you see need to change the financing structure – regarding tariffs – as it is now?

    c. What might be a likely financing model in the future?

    d. So far, the GoE provided a lump sum of LE 20 million for the installation of the GTZ model. What are reasons that there currently is no further contribution?

5. Do you think the establishment of the system did improve villagers' quality of life?

6. If yes, how do you think it improved their quality of life?

## Appendix H: Interview Experts

1. What is your working position?

2. Since when you are working with the project / are you related to the project

3. In the beginning (planning phase), have there been obvious risks / difficulties?

    a. What kind of
    b. How have they been addressed
    c. successfully

4. Do you think that participation of the villagers was enough?

5. Do you think participation of KWSC was enough?

6. Is there trust between CDA/Villagers and KWSC (governance)

7. Regarding the roles and responsibilities of CDA/Community compared to the ones of KWSC – are they clearly defined?

8. In your opinion, why do you think the project concept of GTZ was not replicated more often?

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# إنشاء نظام الصرف الصحي اللامركزي في محافظة كفر الشيخ / مصر -- الصعوبات في تنفيذ خدمات الصرف الصحي اللامركزية في مصر يتمثل من خلال تنفيذ "نموذج GTZ"

اعداد
**تينا إيسيل**

المشرف
**الاستاذه الدكتوره مها هلالشيه**

شارك في الإشراف
**الاستاذ الدكتور هارتموت جيزه**

**ملخص**
لقد تطورت شبكات الري و امددات المياه في مصر تحسنا كبيرا خلال العقود الماضية ، ولكن لا تتطابق نسبة التحسن الى الحد ذاته حتى الآن في خدمات الصرف الصحي ، وبشكل رئيسي في المناطق الريفية التي تعاني من نقص شبكات الصرف الصحي المناسبة. ونتيجة لعدم كفائة طرق معالجة مياه الصرف الصحي والتخلص منها ، فإن السكان والبيئة على حد سواء مهددين بشكل متزايد للتلوث والظروف الغير صحية. ويمكن التغلب على هذه المشاكل في الريف المصري عن طريق إنشاء شبكات الصرف الصحي اللامركزية.

تهدف هذه الدراسة إلى التحقيق في الصعوبات لتنفيذ خدمات الصرف الصحي اللامركزية في مصر. لهذا الغرض ، كان البحث و الدراسه في "نموذج جي تي زد" -- لنظام الصرف الصحي اللامركزي ، في محافظة كفر الشيخ في مصر.

من خلال استعراض الوثائق العلمية ذات الصلة بالموضوع ، وكذلك من خلال مراجعة وثائق المشروع ، والمقابلات والمشاورات مع مختلف الأفراد ذو الصله بالموضوع، جرى تحقيق شامل لدراسة خوائص و ميزات مختلفة ذات الصلة بالموضوع. وركزت الدراسة أساسا على الجوانب الاجتماعية والاقتصادية والمؤسسية ، مع الإشارة بوجه خاص إلى نظام الإدارة الحكومية. و لأن هناك نقص في المؤلفات العلمية التي تتناول هذه الجوانب ، يمكن اعتبار هذه الدراسة بمثابة مساهمة هامة نحو سد هذه الفجوة.
وقد اثبت البحث إلى أن إنشاء خدمات الصرف الصحي اللامركزي تواجه صعوبات لأسباب مختلفة. و ترتبط هذه الأسباب ،على سبيل المثال، إلى النهج المستخدم، والذي يعتبرنهج جديد نسبيا بالنسبة لمصر ، والذي يتطلب إعادة توزيع الأدوار والمسؤوليات بين السكان والحكومة ، فضلا عن الالتزام بوظائف وواجبات كل من مجتمعات القرى والإدارة الحكومية بصفة خاصة.

ومن الأسباب الأخرى وهي ، على سبيل المثال ، متطلبات معينة مثل أراضي للمشروع والتمويل ، وغيرها.
ومع ذلك، جميع الصعوبات والمعوقات ، يمكن تلخيصها تحت فئتين رئيسيتين : الإدارة الحكومية و التمويل.
وتثبت الدراسة أن إنشاء خدمات الصرف الصحي اللامركزي في مصر يمكن حل المشاكل المذكورة أعلاه و المرتبطة بالصرف الصحي ، وأنها تساعد و تسهم في الوصول إلى هدف الحكومة من تغطية التجمعات الريفية و المناطق النائية لخدمات الصرف الصحي. و تستنتج الدراسة ايضا أن أن المعوقات والقيود التي تواجه المشروع يمكن التغلب عليها ، إذا ما أخذ في الاعتبار بعض الشروط المسبقة. توصيتان رئيسيتان هما ، أولا الأخذ في الاعتبار الوقت المستلزم، والمطلوب لأحداث التغيرات بـالإدارات الحكومية، وثانيا ، مراجعة وتعديل نظام التعريفة الحالية التي تستخدم في مصر.